

# Popular Mechanics

MAY 1983

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How To Install  
Any Telephone And  
Add Extensions



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Of Watchful Care



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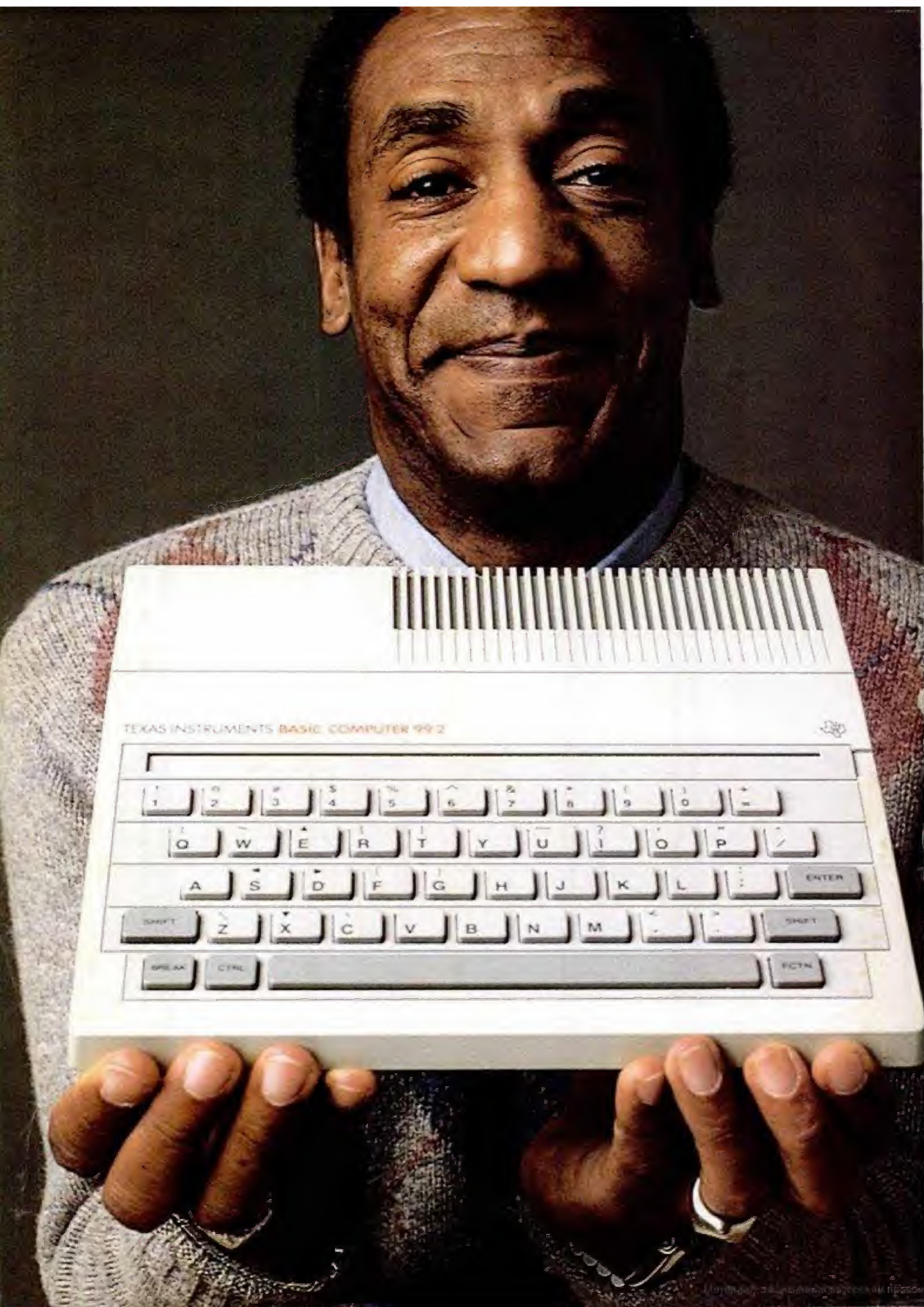
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**MARINER**  
OUTBOARDS





# Popular Mechanics®



## ON THE COVER

Loving care by Harry M. Steele of Coral Gables, Fla., has kept this '57 Thunderbird in like-new condition for 26 years. You can do the same. PM shows you how in our big, 70-page Car Care Guide that begins on page 111.

—PM photo by Tom McCarthy

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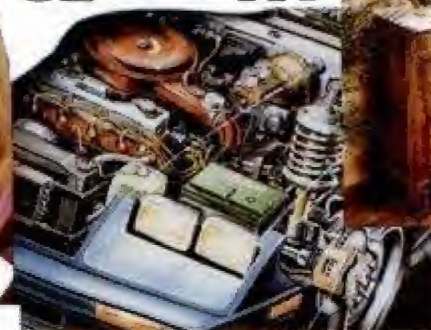
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# EDITOR'S NOTES

John A. Lindtner

**S**o you think car care is a dull sort of business? Well, take a cue from our cover models and you can turn it into a social event (right).

But *dull* is not in Auto Editor Tony Assenza's vocabulary when he talks of car care. It's *neat*, he says in highest acclaim. Install a radio. Change shocks. Tune the engine. Do an entire *Car Care Guide* that really shows readers how to add years to a car's life. It's all neat. That enthusiasm, along with Tony's years of practical



**Models Lynne Jefferson and Arek Andersson tend to car washing while PM's Assenza has his kind of fun.** hands-on experience, make this year's Guide (page r. You could get hooked!

**Brooklyn Bridge.** Just as San Francisco is everybody's home town and the Mississippi is our all-American river, the bridge is the nation's most cherished span. This month, it's having its 100th birthday.

Some said in 1883 that the bridge would not stand 10 years. Now engineers say it can easily last another 100. Every step in its building was an engineering achievement, as contributor Don Sayenga tells in this issue (page 84).

There was a significant design omission, points out John Wiedeman, president of the American Society of Civil Engineers. There's no place for a toll booth. So the old advice still stands: Don't buy the Brooklyn Bridge. You'll never get your money back.



*No space for a toll booth. Wiedeman tells me and Science Editor Dennis Eskow.*

# Travel with the Old Timer.



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2. Enter often, but each entry must be mailed separately. Entries must be postmarked by September 30, 1983, and received by October 15, 1983. No postcards, metered mail or mechanically reproduced entries will be eligible to win.
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**There's only one way to play it.**



# LETTERS TO THE EDITOR



## Throwaway cars: Coming or here?

Your article *Coming Soon: The \$4,000 Throwaway Car* (page 92, Feb. '83) only illustrates further how far out of touch Detroit is with reality. To build a car more efficiently and still make it better—not worse—should be a natural product of industry evolution. Wake up, Detroit—you've only been at it since the turn of the century!

DANNY WONG  
LOS ANGELES

Who would buy such a pile of junk? I

have a '71 Caddy, a '73 Olds and a '79 Rabbit. I cut the cost of cars by taking good care of them and driving them longer—not by buying a small, under-powered, plastic toy that will self-destruct in a few years.

PATRICK M. KIPPES  
COLBY, KAN.

A disposable car? Detroit's been building those for years!

DELMAR J. SCOTT  
MOLALLA, ORE.

for us and our children (now fully grown). I hope it may do the same for some other PM readers.

ALFRED C. WEBBER JR.  
WILMINGTON, DEL.

*It's good to know that PM projects can stand the test of time. For others who may be interested, photocopies of the original article are available for \$3.75 postpaid from Popular Mechanics, Box 1014, Radio City Station, New York, N.Y. 10101. For a more recent tree house design, see Build This Tree-top Hideaway For Your Youngsters, page 92, Aug. '80.*

## Nimrod not so nimble

I thoroughly enjoyed your article on antisubmarine warfare (*A Deadly Game Of Hide-And-Seek*, page 148, Feb. '83). But you erred in calling the Nimrod a carrier-based antisubmarine aircraft. The Nimrod is a military version of the big, four-engine British Comet jetliner—a craft hardly nimble enough to operate from a carrier deck. The carrier-based antisubmarine aircraft currently used by the U.S. Navy is the Lockheed S-3A Viking. As a former Viking acoustic sensor operator, I feel this fine plane should get some much-deserved recognition.

CARL A. SUTTON  
MADISON, ALA.

*Well, we were half right. The Nimrod is classed as an antisubmarine aircraft, but it operates from land bases, not carriers. The Viking is, indeed, a highly regarded, carrier-based, antisubmarine patrol plane.*

## Stellar ripoffs

A company recently offered to name a star after me for a \$35 fee. In your *Science Worldwide* column (page 8, Feb. '83), you said only the International Astronomical Union can give stars official names. Is there any way that a member of the general public can get a star named after him?

JAMES B. MAYTON  
MONTGOMERY, ALA.

*Science Editor Dennis Eskow replies: Sorry, no. Not only is the IAU the only*

*official star-naming body, but it rarely adopts proper names. Most newly discovered stars are given code numbers to make it easier to keep track of them. Only once in a blue moon is a star named after a person—and then only to honor a great astronomer.*

## PM's tree house, revisited

Your readers might like to see the tree house I built almost 20 years ago (photo below). You used it as the cover story in your June 1965 issue (*Build A Modern Tree House*, page 126).

We no longer own the property, but were in the neighborhood and noticed the tree house still standing in the back yard. It holds many pleasant memories



*Nicely weathered after 18 years, the PM tree house looks as sturdy and attractive as it did on our cover back in 1965.*

## Dead Sea update

In your article on new revelations in the Dead Sea Scrolls (*Science Worldwide*, page 8, Feb. '83), you said an English translation of the scrolls would be out in March, but I haven't seen it. How can I get a copy?

CHARLES J. WITTMAN  
DUBLIN, IND.

*The English translation was published in Israel in March, but a U.S. publication date has not yet been announced. For further information, write to: Information Officer, Consulate General of Israel, 800 2nd Ave., New York, N.Y. 10017.*

## Misleading mpg?

We appreciate your observations on our Pontiac 6000 STE (*Does Twice The Price Mean Twice As Good?*, page 82, Feb. '83). We are concerned, however, that your fuel economy data are questionable. Our evaluations of the 6000 yielded an average of 22.5 mpg for a number of test cars. This is considerably higher than what you reported.

BRUCE MacDONALD  
PONTIAC MOTOR DIV.  
PONTIAC, MICH.

*Auto Editor Tony Assenza replies: All the cars in our test were driven under the same conditions. Our mileage figures were a composite of both road and track trials. We agree that owners of the 6000 will see better mileage than we recorded because they won't be flying around a racetrack. PM*



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Canadian Club, one of Canada's great treasures, offers you a golden opportunity to win. The prize, \$100,000 in pure Canadian gold. Correctly answer the simple question posed on the official entry blank and send it in. If your entry is selected, you win. The 100 people who come in second will get a glittering prize of their own, a one-ounce Canadian Gold Maple Leaf Coin.

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OFFICIAL ENTRY

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Grand Prize—\$100,000 in Canadian Gold or Cash.  
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**Canadian Club.**

"The Best In The House."



# IMPORTS & MOTORSPORTS



## Toyota to build next Chevette

Its miraculously long life is almost over. It never distinguished itself in any way, but it never disappointed its maker, either. It wasn't like some cars, embarrassing their manufacturers, getting them hauled into court and all.

The Chevette was the big GM story in the fall of '75. The 1976 Chevy Chevette was America's own minicar. GM had mobilized to compete with the imports with its own fuel-efficient little metric machine. It was the most basic subcompact when it was introduced and it never really changed much. But, amazingly, it will have survived for a model run of nine years. Next year, not being able to compete any longer, it will be laid to rest.

The Chevette's successor, even though it will roll out of a GM plant in Fremont, Calif., will be a Toyota—a version, it is speculated, of the all-new Corolla, a front-wheel-drive model. The new car, whatever it is or is called, will

be a very competitive, state-of-the-art subcompact, priced at about \$6,000, that will go to Chevrolet dealers. The recently signed agreement between GM and the Japanese manufacturer puts Toyota in charge of building it while GM watches to see how it's done.

Meanwhile, Toyota has a new entry



*Toyota Camry, which replaces the Corona, starts at \$7,798 for the four-door (here) and \$8,048 for five-door hatch.*

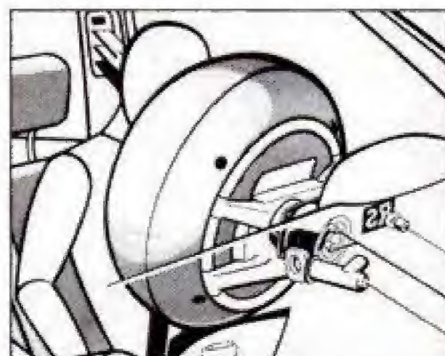
to take the place of the discontinued Corona. The 1983½ fwd Camry uses a two-liter Four transversely mounted, a configuration that's a first for Toyota here.

## High-buck bags

You have to be a damn fool to drive without using your car's seat belts (and we'll hear *no* excuses on this matter). We're all free to be fools, of course—except in those locales where the law says wear 'em.

If you do buckle up faithfully, whether because you're compelled to or because you prefer to *be* than *not to be*, you'll probably care little that Mercedes-Benz will be offering an air-bag option with some of its '84 models. It'll add about \$800 to the cost of the cars it's available on.

The M-B bag on the driver's side is triggered by frontal collisions of 12 mph or more, while on the passenger side an emergency tensioning retractor pulls slack out of the belt. The system, incidentally, is for *additional* protection;



*Mercedes air bag inflates in milliseconds to cushion driver in frontal collisions.*

the cars will retain their usual lap/shoulder belts. So, for a price, Mercedes drivers will soon be safer than ever. That's nice. But remember, the rest of us need only our few cents worth of nylon webbing to avoid a body bag. **FM**

## Futuristic speedster

The classic speedster was Porsche's old 356. Here, by no coincidence, is one for tomorrow. The inspiration for Eberhard Schulz's design came from the 10 years he spent as an engineer at Porsche.

The mid-engine Spyder, to be assembled at his Isdera works near Stuttgart, uses an engine derived from the VW GTI. Fast and topless—what a perfect car for a day in May!



*Isdera Spyder uses Porsche parts, GTI-based engine for speed to match its style.*

## VW's power play

Volkswagen's laying on the cubes and running up the hp as it leaves the Beetle days further behind. Its biggest and



*Second-generation Jetta concept shows all-new body with longer wheelbase.*

most powerful powerplant was just introduced for the Quantum: The 100-hp, five-cylinder, ohc, in-line engine displaces 2,144 cc. And the high-performance, 1.8-liter GTI Four made the Rabbit a whole new car last October. The 1.6-liter turbodiesel was also introduced at that time. The fourth new engine for '83 is a hot 82 hp: the 1.9-liter, water-cooled Flat Four designed just for the Vanagon. Next on VW's agenda is some new sheet metal for '84, starting with the Jetta.



*The \$800 bag is stored in steering wheel.*





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Right, Plasti-Kote makes painting jobs disappear a lot faster.

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You'll find double-wall bed construction and brawny 5-speed overdrives. You'll find why more truckers drive Nissan-built compact pickups than any other.

And you'll agree: the newest Nissan is one heck-of-a-hunk-of-a truck.

## ONE HUNK-OF-AN ENGINE. The most power of any standard engine in its class.

More than Toyota, Chevy S-10, Ford Ranger and everyone else.

- More horsepower: 103 hp @ 4800 RPM.

**2.4  
LITER**

- More torque: 133 ft.-lbs. @ 2800 RPM.
- Exclusive NAPS-Z overhead-cam engine uses two sparkplugs per cylinder, crossflow hemihead and unique "fast-burn" design to give maximum operating efficiency, minimum pollution.
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## The most power of any standard 4-cylinder diesel.\*

Nobody else has a 2.5-liter diesel this brawny.

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- More torque: 114 ft.-lbs. @ 2000 RPM.
- All new technology for rugged durability and superior performance.

## ONE HECK-OF-A CAB. Seat 3 in a conventional cab, 4 in the King Cab.®

- More hiproom than Chevy S-10 or Toyota.
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- More headroom, and legroom, than in any Nissan-built truck ever.
- The original King Cab: up to nine cubic feet of extra inner space for safe storage and jump seats.
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## The Sport Truck that lives up to its name.

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- AM/FM multiplex stereo—standard.
- Day/night antiglare mirror on all Deluxe and XE models.



\*Normally aspirated. Available soon. †Not available in Calif. and high-altitude areas.

†Mfr's. sug. retail price excluding title, tax, license and destination charges.

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## ONE HECK-OF-A-HUNK- OF-A 4 X 4. On-demand 4-wheel drive.

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- Missing from Toyota.
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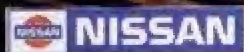
EST HWY **43 31** EPA EST MPG **43 31** **\$5,995**

\*\* Use estimated mpg for comparison, with standard 5-speed. Actual mileage may differ depending on speed, trip length and weather. Hwy mileage will probably be less.

- Special 2-liter NAPS-Z engine powers Nissan MPG Standard Truck to the highest truck gas mileage.
- Every Nissan truck gives you solid value for your money, with extra features at no extra cost.

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29 **21**\*\*  
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# DETROIT LISTENING POST



## GM A-car wagons coming

After a slow start last year, GM's excellent front-wheel-drive, mid-size, A-cars are beginning to really catch on with American car buyers. This fall there will be new incentives in Chevrolet, Pontiac, Oldsmobile and Buick showrooms: A-car station wagons. These will share the two-door and four-door sedan's 104.9-inch wheelbase and will be little different in overall length.

There'll be a choice of 2.5-liter, fuel-injected, four-cylinder, gas V6 or diesel V6 power and three-speed or four-speed overdrive automatic transmissions. In keeping with current General Motors philosophy, each will have its own specific look and character: basic Chevrolet Celebrity; sporty Pontiac 6000; traditional, family-style Olds Ciera and sophisticated, luxury Buick Century.

We have long considered the A-cars among the nicest-driving automobiles available anywhere, and these new wagon versions offer a logical size alternative between GM's smaller J-car wagons and the larger, heavier rear-drive Gs.



**New GM wagons that are based on the excellent A-car platform will provide nearly as much cargo room as the standard, full-size wagons, but they will have trimmer exteriors along with fuel-efficient four- and six-cylinder engines.**

## Shows give peek at future

More than any year in recent memory, last winter's '83 auto shows offered wide-eyed visitors a glimpse into the automotive future, from 1984 to well beyond.

The philosophies of the Big Three differed substantially on how much and what to show, however. General Motors, conservative as always, took the attitude: "Show 'em what we've got to sell right now." With one exception (Buick), this made the GM car divisions' displays among the least exciting.

Ford Motor Co. proudly displayed its ultra-aerodynamic Probe IV design study, along with a Continental Concept 100 idea car that was very close in appearance to the real 1984 Lincoln Mark VII. Chrysler Corp. brazenly showed finished fiberglass models of its '84 G-24 sport coupes (due this fall) and a Mercedes-like two-seater luxury convertible that's likely to reach production in another couple of years.

Chevrolet's display highlighted the new aero-nosed Monte Carlo SS, which will be the basis for that division's NASCAR racers in '83, plus a stock S-10 pickup that successfully finished the 985-mile '82 Baja 1000 off-road race. Pontiac had on hand a replica of Richard Petty's NASCAR Grand Prix, a copy of the special Daytona 500 Trans Am pace car, and one of the show's most tasteless creations: a new-model 6000 sedan with a half-vinyl roof cap and opera windows (it worked in 1975, so let's do it again!).



**A Mercedes-like Chrysler two-seater is only a definite maybe for production now.**



**Ford's superslick Probe IV is claimed to have the same Cd as a jet fighter (0.15).**

The single exception to the generally boring GM displays was Buick's, which featured a fascinating electronic concept car called Questor. A sleek and very rounded open-top two-seater, it was developed in conjunction with GM Design Staff and the corporation's Delco Electronics Div. (For more on the Questor, see *Technology Update*, page 211.)

Ford's bullet-like Probe IV, fourth in the company's series of aerodynamic research cars and a theoretically practical (Please turn to page 16)



**\$2**  
Rebate  
34qt.

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25qt.

**\$4**  
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48qt.

## Here's a rebate that's tough to beat on some tough Igloo® ice chests.

Igloo ice chests are built tough to withstand a lot of beatings. And now, until June 15, their money-saving rebates make them a deal that's tough to beat.

### Get a \$2, \$3 or \$4 rebate on Igloo ice chests.

To get your rebate: (1) Purchase a 25-, 34- or 48-Qt. ice chest between April 15-June 15, 1983. (2) Save your dated sales receipt (circle price). (3) As proof of purchase, clip the group product photograph from the warranty card packed inside each unit or the model number from the carton (include one for each product purchased). (4) Mail the dated sales receipt, proof of purchase and this coupon to: Igloo Rebate, Box PM199, El Paso, TX 79966. Reproductions of this coupon are not acceptable.

Rebate requests must be postmarked no later than June 30, 1983. Requests received after June 30 will be returned. Limit one rebate per product, family, group or organization. Failure to follow instructions will void rebate offer.

Allow 6-10 weeks to process your rebate request. Void where prohibited, taxed or restricted by law. Offer good only in U.S.A. Igloo Corp. will not honor a coupon redeemed by agencies, brokers, organizations or others who are not Igloo retail customers. © 1983 Igloo Corporation.

Check box for each Igloo ice chest purchased.

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☐ \$2.00 on Igloo 34-Qt. Model 347, 348, 349, 857, 858, 859 ☐ \$3.00 on Igloo 25-Qt. Model 7, 8, 9

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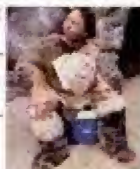
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cal four-passenger, five-door hatchback, has a claimed drag coefficient of just 0.15—which (Ford says) is roughly equivalent to that of a jet fighter plane! To achieve such unbelievably low wind resistance, Ford's aero engineers enclosed the car's underbody, covered its front wheels with flexible plastic skirts, mounted its radiator in the rear, and developed a front air dam that automatically lowers itself and an electronically controlled suspension that adjusts the car's attitude as speed increases.

Continental Concept 100 is an electronics showcase with what Ford believes is "the greatest array of functioning advanced electronics ever assembled in one vehicle." These features include satellite navigation, a remote convenience system, voice-command controls, keyless entry and ignition, cathode-ray-tube and liquid-crystal instrumentation, a Sonar Detection system (for parking and backing, not submarine tracking) four-wheel antiskid brakes, electronically controlled air

suspension, an entertainment system with front and rear controls linked by fiber-optic cables to a remote radio chassis, even an Intellivision video game in the rear compartment. This car is driveable, all its systems are functional—and its styling gives a preview of this fall's '84 Lincoln Mark VII.

Beside the G-24 sport coupes (now officially named Dodge Daytona and Chrysler Laser), the '83½ Shelby Dodge, a Dodge Charger road racing car and a customized Shelby Rampage "Street Fighter" sport truck, Chrysler showed off a terrific-looking two-seat Turbo roadster "to measure public interest in small specialty cars and evaluate production potential." It's based on a shortened LeBaron convertible platform, powered by the same turbocharged 2.2-liter four-cylinder engine that will be optional in the '84 Daytona and Laser, and sports a Mercedes 380 SLC-copy front end. Though Chrysler chairman Lee Iacocca has never been a two-seater fan, ecstatic reactions from nearly everyone who saw this little beauty indicate that it has an excellent chance of reaching production (in time to counter the proposed Buick and Cadillac sports cars).

### Avanti no longer a secret

America's sixth largest—and least known—automaker, Avanti, recently purchased by Washington, D.C., real estate developer Stephen Blake, is fast moving out into the open. Blake has been displaying the sexy 2+2 Avanti at major auto shows and is holding press conferences across the country to publicize the car and his future plans.

For those who don't know, the Avanti was introduced to high acclaim in late 1962. Its mission was no less than to save the foundering Studebaker Corp., but the company folded its automaking operations anyway in 1964. A former Studebaker dealer named Nate Altman then bought the rights, the plant and all the equipment to produce it, and he and his heirs (he died in 1976) have done so, very profitably, for the past 19 years.

The company has kept a low profile throughout that time, hand-building fewer than 200 high-quality, \$30,000 Avantis per year and requiring most of its customers to travel to the ancient South Bend, Ind., plant to pick them up. Since taking over last October, however, Blake has been busy improving the plant's efficiency and upgrading the car itself, which has hardly changed in its 20-year history.

Stay tuned for more after I've visited the plant and driven the car. **PM**



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Ziploc Storage Bags are strong and easy to use. And their tough seal seals out the great outdoors to keep your gear dry.

You can pack hundreds of different things in Ziploc Storage Bags: matches, fresh change of clothes, first aid kit. Just about anything you can think of. And of course, there's no better way to store and carry food.

Next camping trip, let moisture and mildew take a hike. Use Ziploc Storage Bags. The Backpacker Pack.

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# Now! Enjoy a complete home shop at a substantial savings ... in no more space than a bicycle!

Now you can own the woodworking tools you need to turn out precise, top-quality projects. And you don't need a large workshop area, because Shopsmith's space-savvy MARK V uses no more space than a bicycle!

Over a quarter-million American woodworkers have discovered the joys of woodworking the Shopsmith way — while becoming better woodworkers in the process.

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**You'll Save Money . . .** We call the Shopsmith MARK V "the complete woodworking system". Why? Because this extremely versatile tool gives you the five basic woodworking functions — sawing, drilling, horizontal boring, lathe turning and sanding.

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speed motor. That means you save money because it costs you lots less than five individual power tools. You also save a roomful of space!

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Address

City

State  Zip

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Vandalia, Ohio 45377

Dept. 3606

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Quality Woodworking  
Tools Made in U.S.A.



CAR  
CLINIC

## Lynch mob

I'm ready to strangle my 1978 Chevrolet Malibu, which has a V6 200-cu.-in. engine. For over two years it has, on occasion, sputtered and lacked power on acceleration. Even flooring the gas pedal won't stop it from fluttering along at 20 to 30 mph. As luck would have it, the engine has acted normally when mechanics checked it out. But now we've got it. The other day it performed badly for my most recent mechanic, who found that three cylinders on the passenger side of the engine weren't firing. However, he can't figure out why. Can you tell us what to do?—Dennis J. Lynch, Jacksonville, N.Y.

Sure—replace the pickup coil in the High Energy Ignition (HEI) distributor. The pickup coil on this engine causes a little less voltage to be generated in the three cylinders on the right-hand side of the engine than on the left-hand side.

Thus, when something disrupts the voltage output, the three right-hand cylinders are affected while the left-hand three may not be. That "something" could be pickup coil susceptibility to excessive heat, cold or humidity. Or it could be a poor pickup coil connection or broken winding.

Whatever the case, the pickup coil is the key, so replace it.

P185/70R13s on the left and two of your P185/65R14s that may still be in good condition on the right. This would create a dangerous driving situation.

## Rings have their fling

This letter concerns a 1980 Buick Skylark (2.8-liter engine) that I recently bought from a private party. The car is equipped with power steering. When the engine is first started, the steering wheel is hard to turn, but it frees itself after a few miles of driving.

I asked the previous owner about this and he said the car's been that way since it was new. He told me the dealer had said the condition is normal. My friend's Pontiac Phoenix is the same way, so I think maybe the dealer is right. Is he correct?—R.H. Thompson, Terre Haute, Ind.

No, he's not. The problem can be solved by replacing the four rack-and-pinion steering valve body rings with a new kit that carries part No. 7840573.

The rack-and-pinion steering valve  
(Please turn to page 22)

## Tire trauma

My 1981 Plymouth Reliant SE (Special Edition) came with a heavy-duty suspension system. Goodyear Ariva P185/65R14 tires were part of the package. I now need two new tires and find that Goodyear dealers are asking \$89 per tire. Too high, I figured, so I started shopping. It was a waste of time.

No other tire manufacturer makes a P185/65R14 tire, and I've been told that no other size tire will fit. Is this true?—Donald Geczi, East Brunswick, N.J.

Another size will fit, but I don't know if you'll want to use it.

K-cars have three designated tire sizes. The P185/65R14 (Goodyear Ariva) is designed to handle the heavier loads which can be carried by the higher-priced 1981 and 1982 Reliant and Aries SE models and the 1982 Chrysler LeBaron, Dodge 400 and station wagon. These have heavier suspensions. Other model K-cars, which use P185/70R13 or P175/R13 (sizes made by most tire manufacturers), have suspensions that can't carry the loads the others can handle.

You could buy four 13-inch rims and wheel covers, and four P185/70R13 tires for your SE model, but you will sacrifice the car's load-carrying ability. Braking and handling may also be affected.

What you should not do is substitute

another size 14-inch tire, since the fender housings will bottom against the tires on bounces.

Something else you should not do is use tires of one size on one side of the car and tires of another size on the other side of the car—for example, two

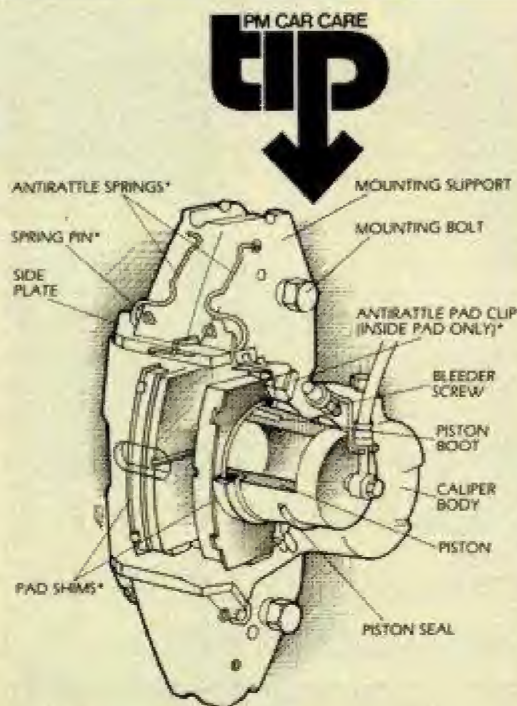
## Like a stuck pig

Don't buy the story that disc brake squeal is a normal condition. It isn't.

A major reason for brake squeal is loose disc brake pads. If the brake pads aren't tight in the caliper, they will vibrate. If the frequency of the brake pad vibration is high enough, it will create a sound like a squeal.

The most reliable method of avoiding brake squeal from loose pads is the installation of new hold-down springs, clips and shims (if they are used) when replacing the disc brake pads. Hold-down springs, clips and shims are usually included in the replacement pad kit.

If there are no shims in the replacement kit and they are recommended by the pad manufacturer, you should spray adhesive on the backs of the disc brake pads to help deaden the sound.



\*PARTS TO REPLACE WHEN INSTALLING NEW PADS TO AVOID SQUEAL (NOT ALL BRAKES HAVE ALL OF THESE)



# Live the Legend



## Dunlop Radial Rovers

Dunlop's heritage of quality, innovation and triumph is legendary... proven at the most grueling off-road race, the East African Safari Rally.

Since this race began in 1964, Dunlop has won an incredible 15 times!

We apply this racing technology to our light truck radials, so when you bolt on a set of Radial Rovers, you'll bring the legend to life on your pickup, van or 4x4.


Dunlop Radial Rovers... RV, Rib and Traction... let you tame the back roads with twin steel belts reinforced by belt guards for trailblazing strength and durability.

And whether you're clawing your way through the rough stuff, or breezing along the superhighway, Dunlop Radial Rovers deliver the smooth-rolling, sure-footed confidence that comes from riding on a legend.

And they do it all with the rugged styling of raised outline white letter sidewalls.

Ask your Dunlop dealer which Radial Rover fits your driving needs.

Backwoods, beach, or boulevard, live the legend with Dunlop Radial Rovers.

 **DUNLOP**  
*For the long run*

Dunlop Tire & Rubber Corp., Buffalo NY 14240



## CAR CLINIC

(Continued from page 20)

body rings presently in your system don't have sufficient resiliency to seal properly when they're cold. Therefore, not enough pressure builds up in the steering gear, and steering remains difficult until the rings "loosen up" and seal.

Incidentally, you may continue having a problem if the service technician forgets to flush the system to get rid of foreign matter before installing the new rings. It's worth it to remind him.

### Keeping 'em rolling

*I desperately need a new crankshaft pulley for a 1960 Oldsmobile, but no dealer, parts outlet or salvage yard around here has one. Please help.—Joseph R. Avignon, Bronx, N.Y.*

I picked your letter because it echoes scores of others I get. I suggest that those who own older model vehicles for which they're having trouble getting parts buy a copy of *Hemmings' Vintage Auto Almanac*.

The latest edition contains over 3,000 entries of services and businesses throughout the country that specialize in older cars and pickup

trucks. Listings include parts and accessory supply outlets, dealers in old cars, restoration shops, salvage yards and sources for technical literature.

In your case, I found four companies that may have the crankshaft pulley you need.

Your best shot is to contact Lyle G. Nobles, R.D. Box 231, Bolivar, N.Y. 14715. (716) 928-1886. The listing describes this business as being engaged in the selling of engine parts for older models—"specializing in Oldsmobile."

To order *Hemmings' Vintage Auto Almanac*, send \$9.95 to Box 945R, Bennington, Vt. 05201.

### Unknown connections

*How do I adjust the ignition timing of a 2.3-liter engine in a 1980 Ford Pinto with manual transmission and no air conditioning? I've been trying to do it according to instructions on the decal in the engine compartment, which say to disconnect the module connector. But there are two connectors on my engine, and I've tried disconnecting one, then the other and finally both. In every case, the engine dies. What gives?—Don Nestor, Hinckley, Ill.*

A wrong decal, that's what.

The ignition systems of 1980 2.3-

## Recalcitrant reluctor



Call it what you will—a trigger wheel, reluctor, armature—it's a part of many electronic ignition systems (the HEI is an exception) that can cause an engine performance problem if it's damaged. So if you can't find the reason for hard starting or missing, inspect the reluctor. Replace one that's cracked or chipped.

If it looks okay, use a plastic feeler gauge to determine if the gap between the reluctor and pole piece is correctly set. Check your service manual or ask a dealership service manager for the recommended specification.



RELUCTOR (ALSO CALLED ARMATURE TRIGGER WHEEL)

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Today's hair styles are neater, shorter and more natural. That's THE DRY LOOK® look. And THE DRY LOOK has a special 12-hour holding formula so you can keep that well-groomed look all day—even if you have fine or thinning hair. THE DRY LOOK hair spray. It keeps today's look looking good all day.

**The Dry Look.**  
12-hour holding power.

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NATURAL LEAF WRAPPER

## A&C GRENADIERS-THE TASTE LEADER

liter engines have either two or three connectors.

Engines that have three connectors have as part of a number embossed on the ignition module the digits 12A224. With this unit, the connector having yellow and black wires has to be disconnected to accurately time the ignition.

With your engine, you don't need to disconnect anything. To adjust the timing, place the transmission in NEUTRAL and bring the engine to operating temperature. Then disconnect the vacuum hose from the distributor vacuum advance connection and plug the hose opening. With the engine running at 850 rpm or less, adjust timing to 6° BTDC.

### Whistling from Dixie

*My 1979 Chevrolet Impala six-cylinder engine developed a persistent whistling noise when idling or running. Since I bought the car, I've had to have alternator diodes replaced twice. Now, the Chevy dealer tells me that the noise, which he calls magnetic whistle, is something I'll either have to learn to live with or get rid of by installing a new alternator. Can you tell me what's going on?—Herbert Beers, West Palm Beach, Fla.*

This may be an example of a left-handed alternator having a right-handed mentality, or vice versa.

To find out what I mean, examine the alternator to determine in which direction the fins point. Now, let the engine idle and then check to see in exactly which direction the fan (pulley) rotates.

Is it turning in the direction opposite to the one in which the fins are pointing? If so, this would readily account for both the whistle and diode trouble.

If the fan and fins are in different directions, the amount of air needed by the diodes to stay cool is being curtailed. That's why diodes are burning out.

As for the whine or whistle, that has to do with the erratic movement of air over the backward fins.

In order to correct both the noise and diode problems, you should replace the alternator end cover with one that has fins which point in the same direction as the pulley rotates. **PM**

### DO YOU HAVE A CAR PROBLEM?

Just ask Mort about it. Send your question to the Car Clinic, Popular Mechanics, 224 West 57th St., New York, N.Y. 10019. While letters cannot be answered individually, problems that are of general interest will be discussed in the column.

### SERVICE TIPS

■ A noise from the front suspension of a 1983 Aries, Reliant, LeBaron, Dodge 400 or Dodge 600 on severe turns or over bumps can be corrected. First, though, the noise has to be isolated to one of three areas. Technical service bulletin (TSB) 02-10-82 advises dealership mechanics how to do this and then how to make the repair.

■ If your late-model Buick-built 3.8-liter V6 engine is burning oil, you may have a valve stem seal problem or the intake manifold may not be sealing properly. The latter situation could allow oil to be drawn out of the galley through the intake ports and into the combustion chambers. If this is happening, replace the intake gasket and torque manifold bolts as instructed in the service manual. If oil consumption continues, have valve stem seals checked. They may have to be replaced.

■ A 1981-83 Ford Escort or Mercury Lynx may also have an oil-loss problem—this because of the RTV sealer used in production. It's not effective. So, if oil is seeping from around the rocker cover of your 1.6-liter engine, install a new cover gasket (part No. E3FZ-6584-A) according to the instructions in TSB 82-26.



# HOMEOWNERS' CLINIC



## Ventilation problems in the attic

*The 2-ft.-wide eave of my house has to be painted every two or three years because stains that resemble mildew begin to appear. Would this be caused by the kind of wood, or do I have a ventilation problem?—James D. Webb, Neon, Ky.*

Jim, it does indeed appear that your

attic may not have adequate ventilation. If there are soffit vents, they might be covered with insulation. The minimum amount of free air ventilation should be  $\frac{1}{150}$  of the ceiling area. For example, a 20 x 30 ft. house has a 600-sq.-ft. ceiling area. Minimum ventilation ( $\frac{1}{150}$  of 600) is 4 sq. ft.

Dr. Tim Maxwell and lab director Tom Pruitt at the Woodburning Lab, Auburn University. Unfortunately, we came up with nothing definitive. There are several angles to consider, as the draft does not appear adequate.

Most coal stoves have recommended drafts. You can check this with a manometer; it should register .05 in. of water (this is taken in the flue).

The location of the stove in the house is important. If the stove is in the lower level of a trilevel, 14 ft. of chimney may not be enough. Large trees can interfere with your draft, causing high-pressure areas around the chimney. You could have air leaks in your house, causing air to rush out the cracks, creating a lower pressure around your stove.

Opening a window very slightly sometimes helps, but it must be on the pressure side of the house. Opening or closing doors on certain rooms can sometimes affect the air pressure in a house. In airtight homes, kitchen and bath exhaust fans can cause a down draft in the flue by reducing room air pressure.

## Exhaust fan for painting

*I'm building a small paint booth in my home to paint model cars. I want to exhaust the spray fumes outside. I need a fan that exhausts about 100 cu. ft. per min., and will discharge into a 3-in.-dia. duct.—Lawrence Nally, Pittsburgh*

The closest I can come to a suggestion is one from W.W. Grainger Inc. (general office, 5959 West Howard St., Chicago, Ill. 60648). They have a tube axial fan (No. 4C659) that has a 12-in. diameter and moves 1300 cu. ft. per min. The fan with a drip-proof motor (No. 7F920) costs \$237.85; the fan with an explosion-proof motor (No. 7F922) is \$317. The company has distribution centers across the country. **PM**

*Do you have a home-maintenance or repair problem? Send it to Homeowners' Clinic, Popular Mechanics, 224 West 57th St., New York, N.Y. 10019. Letters cannot be answered individually, but problems of wide interest will be discussed in the column. For more home-repair and maintenance help, get PM's Home Care Guide, \$4.95 postpaid. Send your order(s) to Popular Mechanics, Box 1014, Radio City Station, New York, N.Y. 10101.*

## Going to the well

*While trying to measure the depth of water in my well, I accidentally dropped a 9-ft. piece of molding down the 1½-in.-dia. well pipe of my summer home. From the top of the pipe to the water level it is 18 ft. I'm taking quite a kidding about this (with no solutions, however), and I'd like to get the molding out. Any ideas?—James Lindberg, New York*

If you have the patience, I've got the solution. Fasten two 12-ft. sections of ¾-in. quarter-round molding together (see sketch). Tape them firmly after

the pipe, and start fishing. If you can't use 12-ft. pieces, you may have to splice together shorter pieces. To play it safe, you may want to fasten a long piece of mason's line to the top of the probe.

## Smoking stove

*Like many other people, I installed a wood-burning stove in my trilevel house several years ago. It was recommended for the square footage of my house. However, from the start, smoke blew out through the door as soon as it was opened for stoking. We couldn't use the stove with the doors open at all. The shop where I purchased the stove recommended adding 2 ft. of chimney, which I did. The original installation had 6 ft. of single-wall pipe from the stove to the ceiling, then another 6 ft. of triple-wall pipe, topped with a traditional rain cap. Adding 2 ft. of pipe did nothing.*

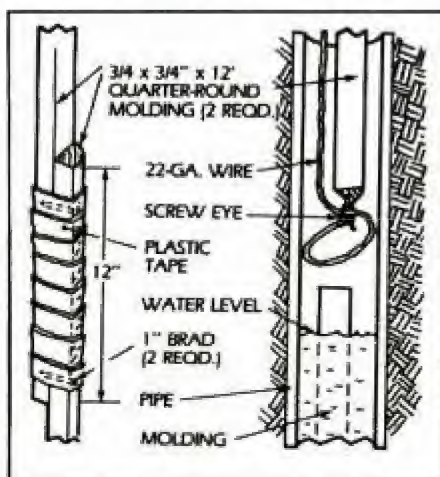
*I also altered the rain cap and filled the spaces between the three layers of galvanized metal with vermiculite, as someone claimed circulating air drafts were prematurely cooling the stack fumes. This accomplished nothing.*

*Finally, I traded stoves. You guessed it, the new one smokes.*

*Now I have a beautiful new stove which heats the house wonderfully and efficiently, but we can't open the doors without smoking the place. Help! By the way, I am blind and receive PM in its braille edition. I read it cover to cover—three separate volumes—each month.—Robert Caron, Evans, Colo.*

Robert, we thank you and take our hat off to you. You remind me of a special friend, also blind, who is an electrical engineer.

I checked your stove problem with



**A tool made of two pieces of quarter round taped together (detail, left), a screw eye and a wire loop at one end (detail, right) retrieves molding from pipe.**

nailing them together. At one end install a screw eye, similar in size to the old hook and eye on screen doors. Use a 22-ga. soft wire to fashion a loop to snare the molding. This soft wire will hold its shape, but is ductile enough to pull through the screw eye.

Form the largest loop you can fit in





## With some mowers, the real trouble starts when the mower won't.

Let's face it, even the most dependable lawn mowers eventually need service. But if you own a John Deere, you've got something the other brands just can't offer. A John Deere dealer.

Not only does he have a large selection of parts already on hand, but anything he doesn't have, he can usually get within 24 hours through the FLASH™ computerized parts system. So you'll be out of the shop and back on your lawn in no time.

Of course, the way John Deere mowers are built, you probably won't be seeing him for quite some time.

The dependable 21-inch self-propelled model has a powerful 4-hp engine, self-charging electric start and a deep die-cast aluminum deck for efficient, uniform cuts. To save raking, there's a 2½-bushel bagging attachment that fills completely, even in damp mowing conditions. And with rear-wheel drive and large steel wheels, traction actually improves as the rear bag fills.

The deluxe 21-inch mower is also available in a push-type 3½-hp model with manual or electric start. Or you may prefer one of several push-type mowers with an 18- or 20-inch cutting width.

All are easy to start, built to last, and 100% factory checked. And all are equipped with a new safety system that stops both engine and blades if the operator leaves the controls.

For more information, or the name of your nearest dealer, call 800-447-9126 toll free (800-322-6796 in Illinois) or write John Deere, Dept. 62, Moline, Illinois 61265.



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# SCIENCE WORLDWIDE



## Researcher does a slow burn

Better fire extinguishers may soon be available thanks to the research efforts of Penn State chemist Jim Reuther. He created a "fluidized bed" apparatus to make the research possible. The bed is a glass cylinder through which a constant stream of gas moves chemical fire retardants at rates that can be adjusted with mind-boggling precision—down to grains per millisecond. Thus, Reuther can do something no researcher before him could do—determine exactly how much of a given retardant is needed for various types of fires.

His tabletop apparatus also includes a pair of metallic boxes that contain flames fed by any gas Reuther chooses, such as ordinary household air, methane gas or any other fire medium. With his lab setup, Reuther has confirmed and quantified something most householders already suspected. It takes just one pound of potassium bicarbonate to put out a fire that would need 500 pounds of water to do the same job.



*Jim Reuther watches flame as apparatus feeds precise amount of substance being evaluated for use in fire extinguishers.*

## Spitballs and domes

If you listen to major league pitchers, very few have ever seen a spitball. The pitch is outlawed because it is almost impossible to hit and could slow baseball games to a near standstill. Curious as to how baseball players perceive their environment, I polled 75 big-leaguers, including 23 pitchers, before the start of this baseball season. Only three pitchers admitted ever having seen a spitball. (All players were promised anonymity.) Among the 52 non-pitchers, 39 said they had seen a spitball.

When it comes to stadiums, 46 of the players we talked to agreed that domes will enliven the game overall, even though five noted that Houston's Astrodome is tough on home-run hitters. Of course the Astrodome has the longest distance between home plate and the home run fence of any domed stadium in baseball.

Domes in Minnesota and Seattle, however, have calmed outfield winds so much that the baseball pops out of those stadiums for more home-run action.

## Milky Way shake-up

Retired University of Arizona astronomer Bart J. Bok says the Milky Way—our sun's home galaxy—is beginning to show some unexpected bulge. Bok told a recent American Astronomical Society gathering that observations of the past 10 years indicate the Milky Way is probably three times wider than estimated in the 1970s and as much as six times more massive. Much of the added bulk, Bok says, probably comes from the recently discovered galactic corona, an envelope of dust that surrounds our galaxy.

## Handle hands with care

If after working around the garage or shop all day your hands crack and even blister or bleed, you may be overwashing. Robert Warner, Mount Sinai School of Medicine (New York) professor, says men who work with paint, grease and oil generally use the wrong soaps and wash their hands too much. He suggests using superfatted soaps and limiting your hand-washing to no more than a couple of times a day.

## Brits brook American trout

British sports fishermen have been talking about it for a number of years, and now British scientists have confirmed it. American trout are taking over streams once reserved for the brown-speckled native, *S. trutta*. The hardy American cousins are the rainbow trout (*S. gairdneri*) and brook trout (*S. fontinalis*). American trout grow faster in hatchery conditions and tolerate more hostile water environments, such as heat or low oxygen content. Surveying recent British scientific studies of the American invasion in *New Scientist*, researcher Stephen Mills also points out that American trout are better than the natives at surviving British winters.

## Worms turn in sea cave

About the last thing a diver expects to find in an undersea cave is a stalactite—long projections that hang from the ceiling like icicles. They are formed by slowly dripping water, rich in calcium carbonate. A stalactite wouldn't be expected in the turbulence of the Caribbean. But it was in a submerged Caribbean cave off the coast of Belize (formerly British Honduras) that a diver



*Pseudostalactites found in submerged cave are tubes made by sea worms.*

recently found what looked like stalactites. A team at the Smithsonian National Museum of Natural History visited the cave last year and is heading back next month for further studies. Laboratory examination of what are now dubbed pseudostalactites show that they are tubes created by worms living on the cave roof about 15 feet below the water surface. How the undersea tubes are made is a question expected to be answered after next month's dive.

PM





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# THE PM WORKBENCH



## For your workshop bookshelf

More and more manufacturers seem to be getting into the publishing business these days. Most, of course, want do-it-yourselfers (or homeowners in general) to become acquainted with their products so they will buy them.

The result is a plethora of very solid how-to reading at very little cost or, in many cases, for free. Here are a number of booklets and related materials that are worthwhile reading:

The American Rental Assn. has produced a series of folders, each explaining which tools can be rented for which tasks. For example, folder No. 1 discusses tools for working with concrete, No. 2 covers plumbing tools, and so on. The folders are free at all rental centers that are members of the American Rental Assn. You might be surprised at the number and variety of tools that are available to the one-time or occasional user.

Readers considering building a manufactured house will be interested in

Pre-Cut International Homes' color catalog, which shows more than 40 models to choose from. All of the homes are built using their exclusive Thermo-Lam wall system. To get their catalog, send \$5 to Phil Greger, Pre-Cut International Homes, Box 886-PM, Woodinville, Wash. 98072.

*Living With The Sun*, a booklet that describes the benefits of passive solar energy in home design, includes 50 full-color photographs of passive solar homes. To obtain a copy, send \$1 to PPG Industries Inc., 1 Gateway Center, 10 North, Dept. PM-583, Pittsburgh, Pa. 15222.

Another useful offering is a 22 x 34-in., all-in-one hand tool reference wall chart tailored for the professional, do-it-yourselfer and shop classroom. The well-illustrated chart pictures 86 different hand tools. It's \$1 postpaid from Hand Tools Institute, 25 North Broadway, Dept. PM-583, Tarrytown, N.Y. 10591.—H.W.

## Woodburning revisited

Thanks to Dremel, Div. of Emerson Electric Co., 4915 21st St., Racine, Wis. 53406, I spent a couple of hours doing something I have not done in years—burning designs in wood. I can say without hesitation that it's as much fun as ever—perhaps even more fun.



*Design is taped to the wood with carbon below, transferred using ballpoint pen.*



*The burning in then proceeds. You can pick from 12 designs that come with the Dremel kit or you can create your own.*



*Kit includes two hardwood slabs, directions, designs, sandpaper, carbon paper and woodburning tool with one point.*

## Nostalgic brace and bit

Like many woodworkers, I have secretly wished for an old-fashioned bit brace that I could use on projects in my own shop.

My dream was realized with this handsome and exact reproduction of a brace from another era. This nostalgic boring device is made of solid teak with brass bindings.

To make my occasional forays into yesterday's shop habits even more romantic, I have also added the spoon bit set, which consists of nine bits in a handy protective canvas carrying roll.



*Conover Woodcraft's brace is authentic-looking replica of an old-fashioned tool.*



*Spoon bits are perfect for boring dowel plug holes. Old World craftsmen used them to bore chair legs for spindles.*

The bit sizes are  $\frac{3}{16}$ ,  $\frac{1}{8}$ ,  $\frac{7}{16}$ ,  $\frac{1}{2}$ ,  $\frac{9}{16}$ ,  $1\frac{1}{16}$ ,  $\frac{3}{4}$  and 1 in. in diameter, and one bung reamer.

The bit brace (No. C390) is priced at about \$90; the spoon bit set (No. C710) is approximately \$80. Both the brace and the spoon bit set are available from Conover Woodcraft Specialties Inc., 18125 Madison Rd., Parkman, Ohio 44080.—H.W.

thanks to this nifty kit. The kit comes complete as shown and you can start on a plaque as soon as you open the box. Accessory nibs are available at a nominal cost for those who want to be more precise. The kit (No. 1510) sells for \$59.95 at craftsman and artist stores and at hobby shops.—H.W.

If you've come across a new product with some special features, let us know about it. Write to PM Workbench, Popular Mechanics, 224 West 57th St., New York, N.Y. 10019.





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Illustration: STEPHEN M. HAYES



# APPLIANCE CLINIC



## Oven stops after two hours

*My nephew, the troubleshooter for my household, suggested that I write to you concerning my General Electric Americana range, model No. J797CIAV, serial No. DCZ 18035. The problem: After anything bakes for about two hours in the lower oven, the temperature knob light goes out. Then the "bake" oven set indicator knob light goes out. The oven stops heating completely. After a couple of hours have passed and the controls have been reset, the oven will function normally for a while. Then it goes out again. I am hoping you might help*

*locate the source of my problem.—Mrs. Emma Kuzma, Binghamton, N.Y.*

It seems that all of the symptoms point to a damaged oven selector switch. Most likely contacts M and L1 on the switch are badly pitted, causing erratic contact during the bake cycle. When the switch opens, all power is cut off to the bake and oven indicator lights and to the transformer. You and your nephew might want to change the oven selector switch together. The part number is WB22X55. It is still available through General Electric service centers.

## Repairing molded plastic

*I have a Whirlpool refrigerator, Model EDT201ZK. I have a problem with the molded plastic door liner. The liner has broken at the point where the shelf rail that contains stored items is attached. The rail has simply pulled out of the liner. There is also another crack on another shelf. This makes the shelves unusable and reduces the storage capacity of the unit. I've been unable to find an adhesive or method of repairing the door adequately.—John W. McCoy, Sumter, S.C.*

Unfortunately, I know of no satisfactory method of gluing your door liner. It is subject to both torsional and longitudinal stress; it also supports the door to a certain extent.

The only real way to correct your problem is to replace the entire inner door liner. The liner is available at any Whirlpool service or parts center. The part number is 482529. It's about \$58.

## Refrigerator fan switches

I have received several letters concerning burned-out fan switches on Montgomery Ward side-by-side refrigerators. The manufacturer makes a fan switch elimination kit which can be used on 1974 and older refrigerator models. The kit eliminates the switch and lets the fan run constantly.

The kit contains a fine jumper wire and a cover for the hole in the breaker



*This fan switch eliminator kit contains a fine jumper wire and cover for the hole.* trim. The part is No. 69340342; it can be ordered through any Montgomery Ward store or catalog for \$3.

## Storing appliances

*I am going to be overseas for three years and plan to put my washer, dryer, stove and refrigerator into storage. How should they be prepared?—Larry L. Cromer, Sumter, S.C.*

Ideally, appliances should be stored in a cool, dry place to prevent any possibility of rust. Cover the appliances with a blanket or dropcloth to keep the dust off. **Caution:** Store appliances where children don't have access.

**Washer:** Unplug the washer and remove the rear access service cover. Disconnect the drain hoses at the pump. If the machine is equipped with a self-cleaning filter, remove the drain hoses from it also. Allow all the water to drain from the pump, hoses and tub. Disconnect the water fill hoses.

**Dryer (gas and electric):** Use a vacuum cleaner to remove any lint that may have accumulated in the filter or the exhaust duct in the dryer. **Note:** On a gas dryer, when disconnecting the gas supply from the dryer, cap the gas line tubing going into the dryer using a 3/8-in. black iron pipe cap.

**Range (gas or electric):** Clean it thoroughly. If you have a self-cleaning range, position the door-locking mechanism in the bake (open) position. Cap the gas line of a gas range using either 1/2- or 3/4-in. black iron pipe cap depending on the manifold pipe size.

**Refrigerator:** Clean the interior with a solution of baking soda and water. Clean the water collection pan under the refrigerator, if there is one. Spray the door gaskets with a silicone lubricant. The doors should be left ajar a few inches. You might try taping a piece of styrene foam between the door and the cabinet to keep it open. Most modern refrigerators close by magnetic seal, which can be pushed open easily from within. However, as a safety measure for curious children, tie a rope through the handle around the propped-open refrigerator so the styrene foam can't be pried loose easily.

To absorb moisture or odors in the refrigerator, use crumpled newspaper and baking soda on the shelves.

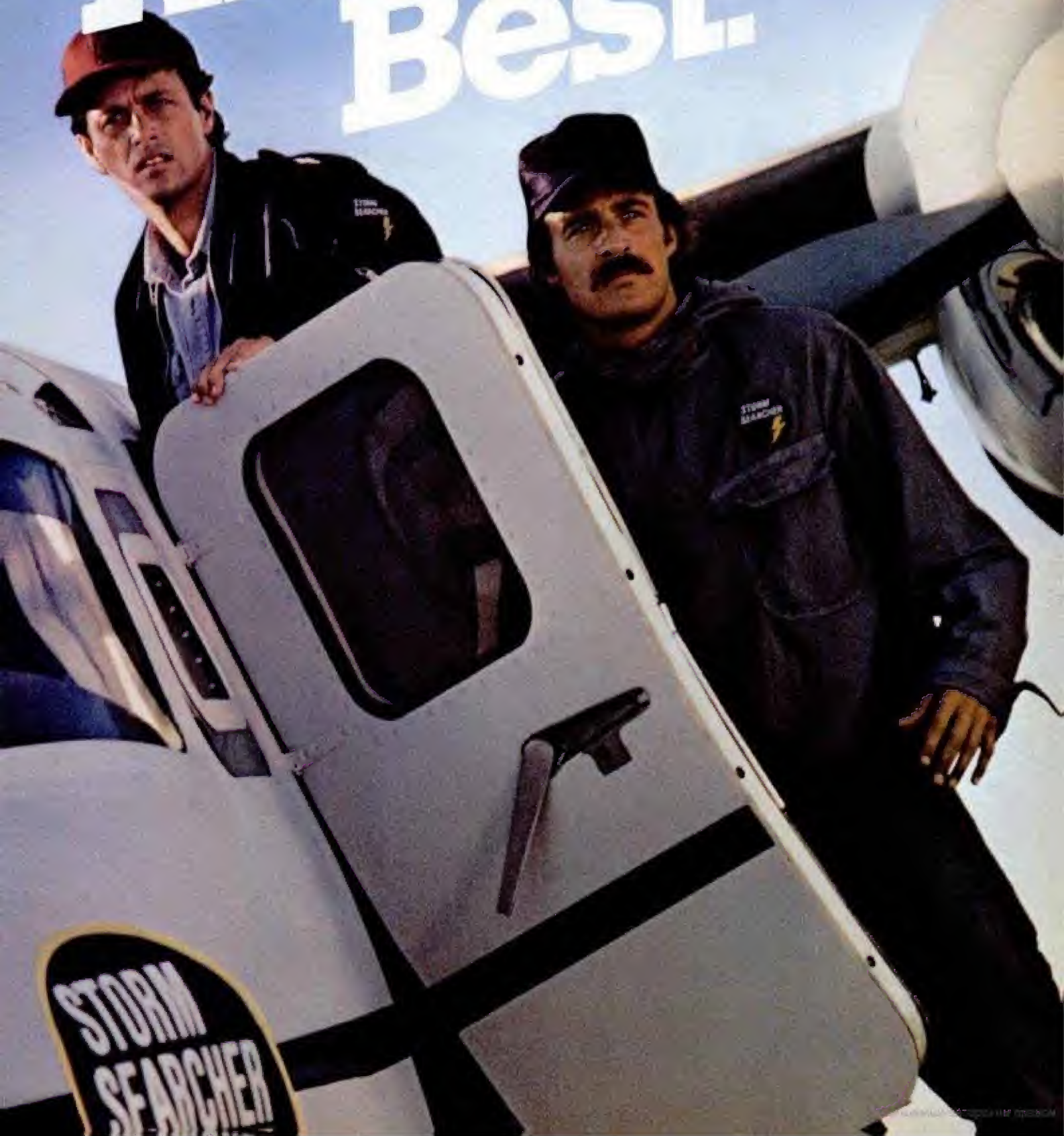
## Electric shaver parts update

Following is the latest on the company supplying parts and service for electric shavers listed in *How To Repair An Electric Razor* (page 132, Feb. '83). The company is: Authorized Appliance Service, 290 Rte. 18, East Brunswick, N.J. 08816. **PM**

*If you have a problem with any appliance, send your question, along with the model and serial numbers, to Appliance Clinic, Popular Mechanics, 224 West 57th St., New York, N.Y. 10019. Sorry, but letters cannot be answered individually. Problems of wide interest will be discussed in this column.*



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### Do-it-yourself prefinished parquet flooring



Now there's a hardwood parquet floor designed for do-it-yourself installation in high-traffic areas of your home such as foyers, hallways and game rooms.

Manufactured by Norwood, the flooring has a durable paste wax finish which the maker claims creates a low-maintenance, mar-resistant surface.

The  $\frac{1}{8}$  x  $9\frac{1}{2}$  x  $11\frac{3}{8}$ -in. solid oak rectangles are installed just like vinyl floor tiles, using a mastic adhesive. The mastic is troweled onto concrete or a plywood subfloor, then the square-edged tiles are laid down.

Norwood parquet flooring comes in light and dark (shown) oak styles. The flooring is at home centers and lumberyards in 50-sq.-ft. bundles for \$1.89 per sq. ft. For the nearest dealer, write to Norandex Sales Co., 7400 Northfield Rd., Cleveland, Ohio 44146.

### Once is enough



Red Devil's Onetime spackling compound is formulated to produce a finished, ready-to-paint surface in a single application. The manufacturer claims that Onetime won't shrink, crack or need sanding prior to painting. Onetime is especially helpful for large holes, which usually need a few applications. Onetime is at hardware and paint stores in  $\frac{1}{2}$ -pint (\$2), pint (\$3.12), quart (\$5) and 1-gal. (\$13) containers. From Red Devil Inc., 2400 Vauxhall Rd., Union, N.J. 07083.

### A golden lining

The Salton Goldfilter II automatic drip coffeemaker features a European discovery for delivering tastier coffee—a 24-karat gold-laminated filter basket. This unique filtering system requires no paper filters and is claimed to brew fine-flavored coffee.

The Goldfilter II, priced at

\$47.50, automatically brews from two to eight cups of coffee. A warmer plate maintains the temperature. The Goldfilter II is at gourmet shops and major department stores. For information, contact Joanna Cumberland, Salton Inc., 1260 Zerega Ave., Bronx, N.Y. 10462.



### Textured wall coverings



Columbus Coated Fabrics has introduced the Satinesque collection, a new line of fabric-backed vinyl wall coverings from Wall-Tex.

The Satinesque collection offers a wide selection of designs from oriental and Victorian to classic and contemporary. Textures range from sleek metallics to nubby tweeds, all in an array of new colors. The new wall coverings come in 156 patterns, making it easy to carry a color scheme from room to room. The wall coverings range in price from \$9.95 to \$21.95 per roll (27 in. wide x  $15\frac{1}{2}$  ft. long). For details, contact Columbus Coated Fabrics, 1280 North Grant Ave., Columbus, Ohio 43216.

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# How To Install Your Own Phone

If you have questions about how to install your own telephones, we've got the answers!

BY MARC STERN

**N**ow that you can buy and install your own telephone, how do you go about it? Here are some of the most asked questions—and answers—about phones and their installation.

**Q: What is a phone's Ringer Equivalency Number (REN) and why do I have to report it to the phone company?**

**A:** The REN, which is in a new phone's operator's manual and/or on the phone itself, indicates the type of ringer circuit in the phone. For operation of its lines, the phone company must know

the type and number of phones you're using.

**Q: Will all phones work on every line?**

**A:** No, not all phones are the same. The phone system uses a form of frequency detection so a phone will ring. For "A" or residential service, the tone is 20 kHz. "B" or "C" service phones need a different tone and won't ring on an "A" line. Most people want the "A."

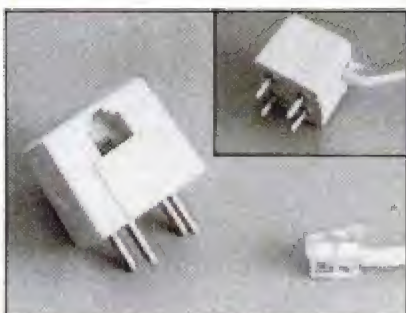
**Q: Speaking of phone lines, I have heard that the more phones you install, the poorer the ser-**

**vice on the whole line. If all the phones are used at once. Is this true?**

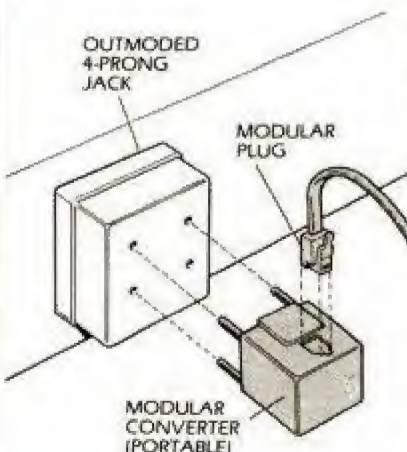
**A:** Yes. The phone company uses a system which supplies 48 volts and between 20 and 35 milliamperes of current, which provides excellent service for one phone. As you add extra phones to the line, you are dividing this current and voltage further and the quality of the service deteriorates. Usually, no more than six to seven phones may be in a house and plugged in at once.

**Q: We often have many listeners on a conversation. Is there any**

## GOING MODULAR



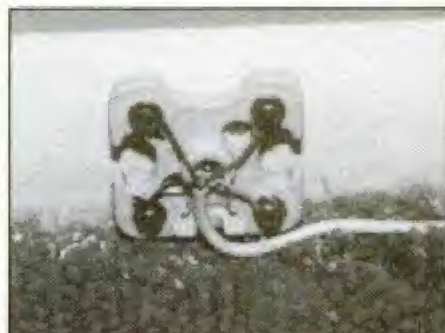
In order to convert a four-prong jack to one that will be able to accept a modular plug, it's necessary for you to buy a modular converter. The modular plug from the telephone will then be able to plug into the converter (below and inset above).



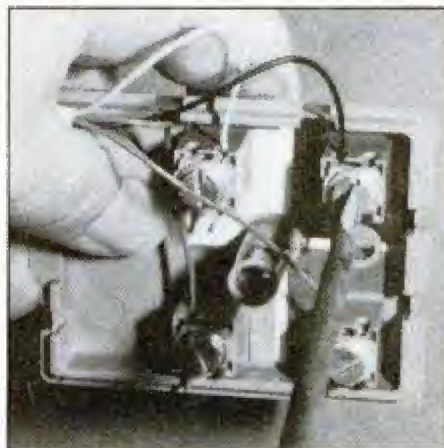
## INSTALLING A MODULAR JACK



A terminal block (above) is found in older homes. It must be replaced with a modular jack. Once that replacement has been made, it's relatively easy to add your own phones.



Taking the top off the terminal block reveals color-coded wires. Carefully unscrew the terminals sufficiently to loosen wires, and then remove unit from your baseboard or wall.



Attach the modular jack's base to the wall and then attach the wires in the same color-coded manner as before. Tighten screws and see that wires do not short against each other.



Snap-fit the connections from the jack cover to the base terminals by simply following the color code. All that you have to do next is to attach the jack cover and you're finished with the job.



**way to improve the quality of the phone service?**

**A:** Yes. Install a speaker-type phone, which allows many listeners to hear a conversation. It should have an amplified output so all can hear the conversation. In this way, the phone line sees only one phone "off the hook" at a time and signal quality improves.

## Going modular

**Q:** I've decided to modernize my home to accept the new modular plug phones. How can I convert them?

**A:** The phone company and many electronics and department stores sell conversion covers for the standard type 42A terminal block. A converter consists of a new cover containing a modular outlet and four color-coded, snap-on clips. These are snapped onto the terminal screws in the block, according to color, and the conversion cover is tightened down. That's all there is to it.

**Q:** But what is a Type 42A terminal block?

**A:** This is the old type of baseboard connector that a telephone has to be wired to. When you take off the cover, you will see four terminals with four different color wires attached. The placement of those colored wires is crucial because they are the key to proper phone hookup. For many years, the phone system has used color-coding as a way to simplify and speed installation.

As a result, when you are installing any conversion device, you must remember to match the colors of the wires to the proper terminals.

**Q:** And, what, specifically, is a modular plug?

**A:** It's little more than a snap-in plug with four conductors in the tip. It mates with a connector inside a modular jack or converter.

**Q:** Why did the phone company make the change to the modular plug in the first place?

**A:** According to the American Telephone Co. (ATC) it was the result of an FCC ruling which mandated standardization between the many phones on the market. The result is an easier plug to use.

**Q:** My house doesn't have terminal blocks; it has two types of phone outlets, four-pronged jacks and flush-mounted terminal blocks. Can I convert them?

**A:** Yes. It's easy to convert a four-pronged jack by using a modular converter. For the flush-mounted terminal, you'll need a flush-mounted modular jack converter. Simply remove the old jack, leaving the wires hanging free, and then install the new bracket and snap-on clips. When this is done, insert and fasten the new modular jack and reinstall the faceplate.

**Q:** I have a wall phone and would like to install a new, modular type of wall phone. Is there any way to do this?

**A:** Converting a wall phone outlet involves removing the old phone by sliding it up and away and then removing the old base plate. When this is done, simply remove the old outlet, leaving the wires hanging. Next, install the new bracket and attach the wires to the converter plate by their color code. When this is finished, tighten the converter into the bracket and attach the new base plate. After this is done, slide the new wall phone over the clips and the job's all done.

**Q:** Can I install a modular plug on an existing phone?

**A:** Yes, the phone company supplies a modular plug converter which will turn your nonmodular phone cable into a modular one. It requires that a four-wire cable be spliced according to included instructions, into the converter, which is then closed permanently.

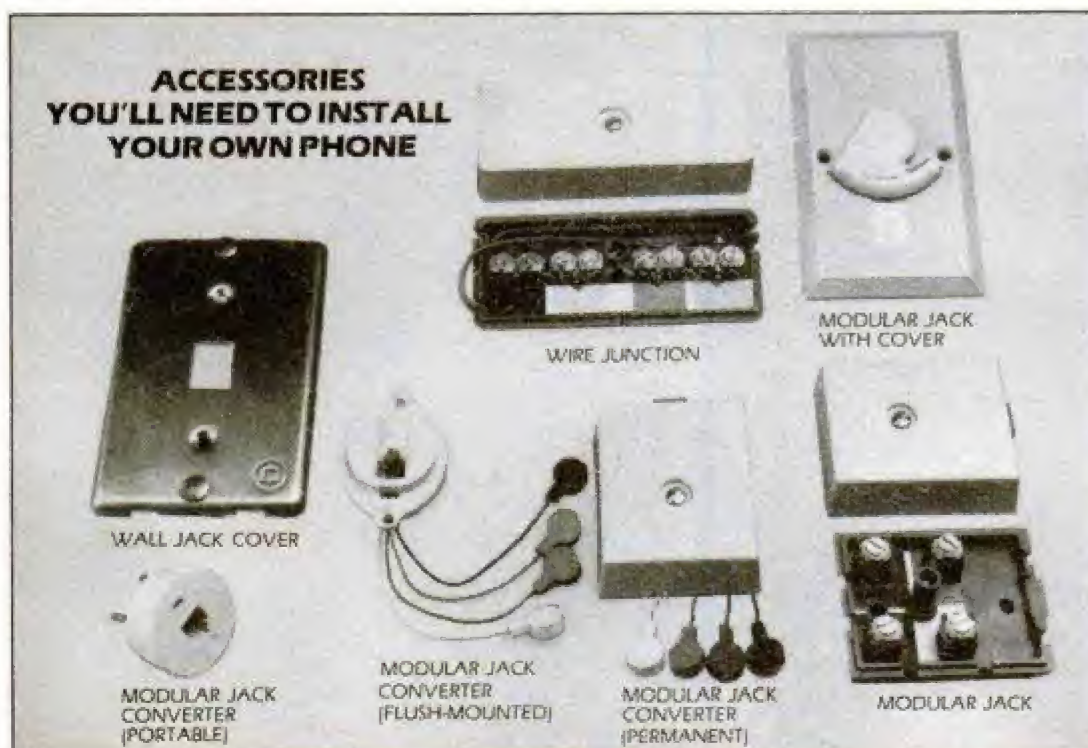
## Extending the wiring

**Q:** What is a network interface and how do I install phone wiring from it to other areas of my home?

**A:** The network interface contains a tiny integrated circuit which protects the phone network from harm by user-installed equipment. It is the demarcation point between the phone company's equipment and private home wiring. It's easy to install wiring beyond this point with a wire junction (see photo). Mount this device near the interface, so they can be connected by the short modular plug cord which is attached to the wire junction.

When this is done, determine the wiring paths for your home's new wiring and then run this wiring through the walls of your home to the areas where you are installing new phone outlets. After the wires are run, strip the outer covering off the ends of the various cables and expose the four conductors inside each cable. Leave the insulation on these thin wires and install them in the wire junction according to their color coding. After you replace the cover, your house is now all wired for phones. Older homes may simply have a terminal block instead of a network interface.

**Q:** Why should I run the wiring through the walls, instead of under the carpet or along the base-



Adding a phone is easy if you use the right equipment. The portable modular converter just plugs into one of the older-style, four-prong jacks, and it can be moved from room to room. The permanent modular converter has four snap-on connections that attach to an existing base. Or you can install a completely new modular jack in place of your old four-prong jack. Once you've gone modular, it's simple to connect extra wiring for extensions. The modular wire junction will plug into a modular jack and allow you to run two additional phone lines. Wall phones can be hung on just about any surface using special baseplates. And you can even get modular jacks with built-in covers that keep the dust out of the connection points.

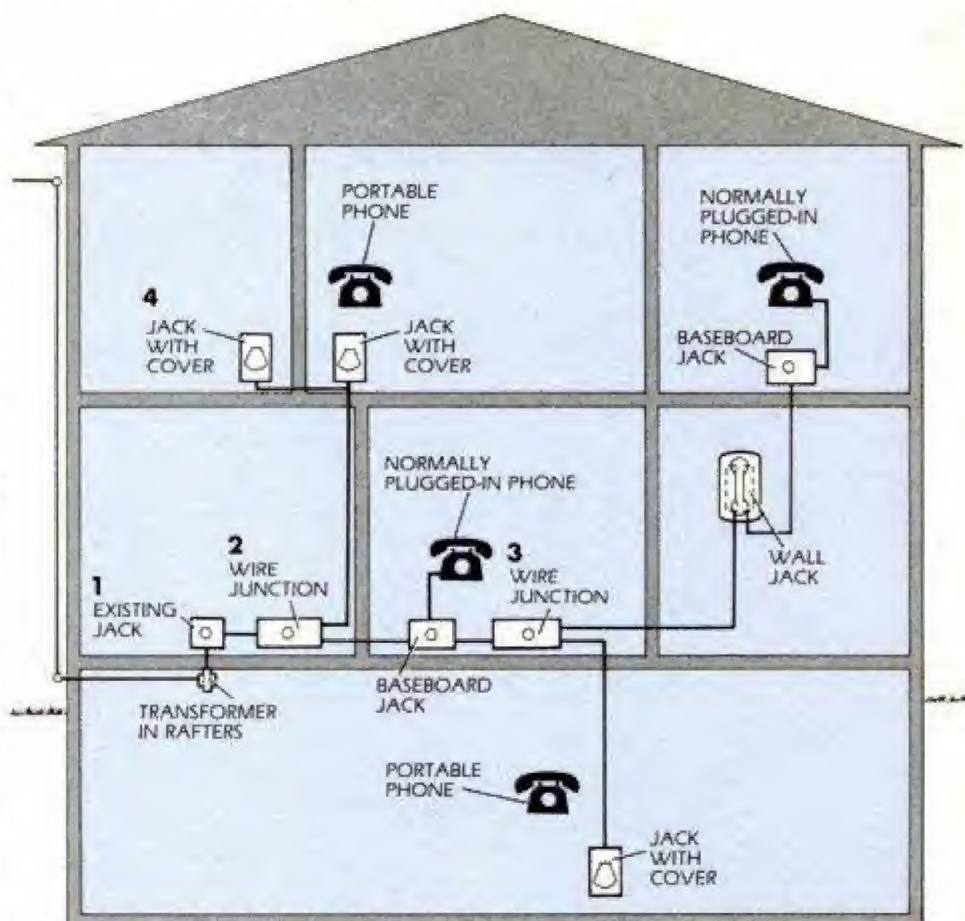


## HOW TO EXTEND TELEPHONE SERVICE THROUGHOUT YOUR HOME

Here's how to install extra extension telephone lines in your home. We show (right) how incoming phone line goes to phone company's transformer and then to an existing jack or network interface (1). At this point you may have to convert the jack to a modular one, as detailed previously. Then connect a modular wire junction (2). One line from the junction may connect to a new jack and from there to another junction (3). Note how the junctions simplify the wiring. Some jacks will have phones normally plugged in. Other jacks (4) may have a phone carried between them. These jacks should be the covered type.



Color-coded wires and matching colors on a wire junction make it quite easy to install.



**board? Also, what type of wire should I use?**

**A:** It's best to use the phone company supplied, color-coded, four-conductor wire. This way, it's easy to make sure the wiring is correct. Running this wire behind the walls ensures maximum protection and prevents an unsightly tangle. Running it under the rug, on the other hand, means there's more chance for damage as people walk on it. Further, it can leave a ridge in the rug. Baseboard mounting is acceptable, provided you run the wire out of any potential walkways and it is secured to the baseboard with *insulated* staples.

**Q:** Is there a maximum distance I can run a wire from the network interface or junction box?

**A:** According to ATC, the maximum limit, before the line resistance and voltage loss become too great to run the phone, is about 250 feet.

**Q:** Are there any other cautions of which I should be aware?

**A:** According to the phone company, a person installing a phone should be sure the installation complies with local building regulations and the National Electrical Code. Avoid placing telephone wires in pipes, conduits or compartments containing other electrical wiring. Never place telephone wiring near bare power wires or lightning rods, antennas, transformers,

steam and hot water pipes or heating ducts.

Before you fasten any wire to metal surfaces—siding, recreational vehicles or mobile homes—be sure that no hazardous voltages are present on the siding or other conducting surfaces. And, you must never run wiring between structures where it may be exposed to lightning. Further, avoid damp locations or any place where wiring would allow a person to use a telephone while in a bathtub, shower or swimming pool.

Never use telephone wire runs to support objects. Be sure that wire is enclosed in electrical tape to protect it when it runs across gratings or other rough metal objects.

When drilling through walls or floors be careful to avoid contact with concealed pipes, other electrical wiring or similar items. Also, you should avoid running wire to temporary structures or to any locations that are not easily accessible, or anywhere the wire will be subject to mechanical stress or pinching such as through door jambs or window sills.

Finally, keep wire runs as short as possible to avoid interference with your phone system and never splice one length of wire directly to another because it can cause interference on your line. Instead, use wire junctions or modular jacks for multiple connections.

### Buying your own phones

**Q:** Do I have to notify the phone company about the type of phones I buy? If I do, what information do I give?

**A:** According to law, you must give the phone company (your local business office) the ringer equivalency number and FCC registration code of the phone.

**Q:** I called the phone company and they told me our system uses pulse dialing. What is it?

**A:** It's a type of service which is associated with rotary phones. Inside a



A wire stripper tool, available from the phone company, is a handy device. The tool, which has a built-in measuring scale, allows you to strip a multicouductor cable without damaging the wires. Afterward, you can use it for other jobs.



dial-type phone (called a rotary) there is a set of electromechanical contacts which turns the number dialed into a precisely timed sequence of electrical pulses. They are sent through the phone line to the central office where they are decoded.

**Q:** Can a pushbutton phone, like a Touch-Tone, be used on such a pulse system?

**A:** It depends. If you have a unit from the phone company (any Bell-brand unit) it will work correctly. And, if you have a phone which has a pulse/DTMF switch it, too, will work correctly in the pulse mode.

**Q:** What is "DTMF"?

**A:** It's Dual-Tone, Multi-Frequency phone service. With it, two tones are generated every time the buttons are pushed. These tones are translated into electronic equivalents and are sent through the system where they are decoded at the phone company's central office. A rotary phone will work on such a system because the system still recognizes pulse dialing.

**Q:** What type of phone should I buy?

**A:** With the wide variety available today, the choice is up to you, but we would think a desk or Triline-type of electronic phone, capable of DTMF, is best from a long-range reliability standpoint.



Anyone who goes to purchase new telephones will find a tremendous assortment of styles readily available at many different outlets. Novelty phones such as Pac-Man [1] dress up a teen-ager's room; leather-clad Genie [2] offers

new materials for your decor; executive-style phones [3] look at home atop a busy desk; and a cordless portable phone [4] lets you roam. (Phones 1, 2 and 3 are from American Telecommunications Corp.; 4 is from Cobra Inc.)

Advanced capability phones may contain other features such as memory dialing, "hold," automatic dialing, redialing of a busy number and display of the time, date and cost of a call.

**Q:** Doesn't the phone company offer such special phones? If it

does, why should I buy a phone with such features?

**A:** Yes, the phone company does offer phones with features such as memory or "speed" dialing a list of phone numbers—or services such as call-waiting and call-forwarding—but all these are extra cost options on your monthly bill. In the long run, owning your own phone with these features will save money.

**Q:** I want to install a portable phone (cordless). Are there any special actions to take?

**A:** If your phone wiring is correctly installed, no special precautions are needed. All you do is plug in the base unit to an a.c. outlet and plug the modular jack into its receptacle. The base unit should be installed away from any fluorescent lighting or any type of electrical motor because you run the risk of picking up transformer hum on the phone's signal to the portable handset.

**Q:** Cordless phones seem convenient, but expensive. Can I get such convenience at a lower cost?

**A:** It depends on your needs. If you only need to receive calls remotely, there are cheaper models of cordless phones which do not have a dial on the remote handset. With these you can answer your phone from your back yard, for example, but cannot place calls.

**Q:** Will I need a special system to take advantage of these cordless phones?

**A:** A cordless phone may be used on any modular system. They require no special installation.

**Q:** When should I start?

**A:** There's no time like now!

PM



## Personal Telecommunications On The Way

American Bell Consumer Products recently showed an exciting new concept in the area of home telephones—the Genesis "telesystem." The Genesis and Touch-A-Matic phones are the first products of this new company.

The modular telesystem allows for various units to be plugged into the basic phone to increase the services it offers. The Touch-A-Matic features such things as storing the last number dialed, automatic redial on busy, touch-sensitive keypad, color-coded emergency buttons and a 12-digit phone number memory.

Genesis adds to this with a plug-in, alphabetic keyboard (the right half of the phone pictured above).

The full-fledged Genesis system uses sophisticated, computer-style modules (one is shown in front of the phone) which can add more memory and functions. But the keyboard is what really makes the Genesis so exciting. Imagine banking from your home, ordering from a catalog and more. Whether these services will be available remains to be seen—but the Genesis telesystem is ready and waiting.—N.S.



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### Taming exposures



High-speed (ASA 400) film can provide great indoor shots, although beaches or snow can give overexposure. A neutral density filter reduces the light reaching the film without affecting the film's color rendition.—Robert Hertzberg

### Cool it



A good way to cook your finger is to grab an aluminum reflector after the photoflood light heats up. Fasten a four-inch piece of dowel near rim of bowl, using a wood screw from inside.

—Robert Hertzberg





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# PM ELECTRONICS MONITOR



## MTV adds a new dimension to music

To the crisp strains of a forceful, yet haunting, rock melody, a lissome girl slithers in a sinuous path across the deck of a sailboat as it races through crystal clear tropical waters. Body-painted in stripes of azure, green and muted gold which boldly outline her facial features, then swoop down to delineate her bikini-clad form, she moves like a dream, a phantasm from another dimension somehow called up by the magic of the music around her.

The song is *Rio*, the rock group is Duran, Duran and the medium is the most exciting new art form to hit entertainment TV since anyone ever loved Lucy. It's MTV, or Music Television Network. From its beginnings in 1981, MTV has grown from supplying approximately 300 cable TV companies

to being a video offering which reaches over 9.5 million subscribers on 1,300 cable affiliates.

Its growth has been little short of phenomenal—its programming is phenomenal. By adding pictures—video—to the music of today, the artists have evolved a new art form. Special effects, as well as imaginative themes, have allowed them to illustrate their ideas and add yet another communication link between artist and audience.

This is not the Rockettes.

Groups like Men At Work (on their video hit *Down Under*) cavort and sing their way out of one surrealistic setting into another, sort of like the Kingston Trio trapped in the Twilight Zone.

This is not a variety special.

"Is this music?" a few people exposed to MTV have been heard to

mumble. "Where are the instruments? They're not even mouthing the lyrics properly."

Back in the 1600s, I can imagine there were people who picked up the Gutenberg Bible and mumbled, "Is this a book? Where are the hand-lettered texts? Did a monk pen this?" MTV is as much the wave of the musical future as movable type was, in its first days, the beginning of modern book production.

Video is now an integral part of music. Already, many rock groups are releasing on videodisc as well as audio records. And it is not solely a rock phenomenon. The Nashville Network is on cable now, too. Can classical music be far behind?

Well, we'd like to examine this in more depth, but Joan Jett is on the tube singing *Crimson And Clover*, and we don't want to miss her taking a bite out of the tulip.

## Robot wars heat up

More and more people are making robots for America's homes and busi-



**B.O.B. (above)** is the latest in new robot designs manufactured for homeowners.

nesses. Not the arms-only, totally-lacking-in-personality robots that man such things as automotive assembly lines: These robots want to be members of your family.

The latest (shown here) is B.O.B.

from Androbot Inc. His name stands for "Brains On Board" and his actions are programmed by the user by means of his three, 16-bit 8088 microprocessors. Besides the microprocessors, he also has two infrared scanners. This allows him to scan his environment and distinguish between living and inanimate objects (as long as your stove is off!).

B.O.B. is the latest offering in home Robotics. However, what can he really do for you?

To quote from B.O.B.'s press release, "B.O.B. (at \$2,495) may walk up to a guest, crack a joke, sing a song, or quote the daily stock market totals." Mmmmmmm, sounds like an advertising salesman to us.

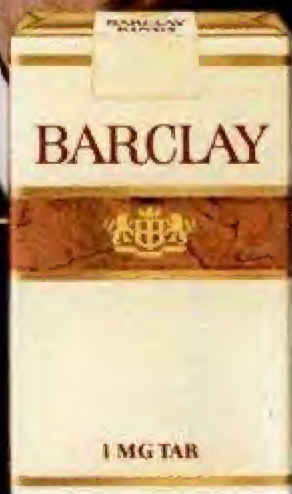
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Rich velour fabrics and supersoft vinyl, thick carpeting and warm woodtones create a quiet place to ride and relax. There's comfortable passenger room for eight with the Dual Facing Rear Seats option. Country Squire even has cargo space no other station wagon builder in America can match. And this year, the Country Squire can be equipped with a new heavy-duty trailer towing package that will tow up to 5,000 lbs.

**Ford Escort. The best-selling\* wagon in America, year after year.**

For 1983, the Escort wagon features loads of new improvements, ranging from a deluxe sound insulation package to a fuel-conscious shift indicator light.

And the front-wheel drive Escort combines the use of high-strength low alloy steel with a unique CVH engine to give excellent fuel efficiency.

**42**

EPA  
EST  
MPG

**29**

EPA  
EST  
MPG

For comparison. Your mileage may differ depending on speed, distance and weather. Actual highway mileage lower.

Whether you buy or lease, see the new LTD, Ford Country Squire and Escort wagons at your Ford Dealer... the Wagonmaster.



FORD COUNTRY SQUIRE



FORD ESCORT



HAVE YOU DRIVEN A FORD... LATELY?







## MADE FOR FISH AND GAME.

Honda has some powerful traveling companions that won't disturb the peace and quiet of your camping or fishing trips. They're our generators and outboard engines.

Honda has a complete line of lightweight, portable generators from 500 to 800 watts. Each one is easy to operate and ideal for lighting up a campsite, charging the boat or RV battery, or powering small appliances.

They all feature an extremely quiet, reliable Honda four-stroke engine. An advanced Oil Alert™ that warns when the oil level gets too low.\* An Automatic Decompression system and CD ignition for quick, easy starts. And a USDA approved spark arrestor muffler so they can even be used in National Parks.

Honda also makes the only 7.5 and 9.9 HP four-stroke outboard motors on the market.

Both offer smooth, very quiet operation and great fuel economy. A built-in 12-volt battery charging capability. CD Ignition for quick, reliable starts. And a high performance carburetor for quick acceleration and steady operation.

So if you're looking for great times in the great outdoors, don't leave home without Honda. Check your Yellow Pages for the Honda Generator and Outboard dealer nearest you.

\*Except on EM500

For optimum performance and safety, we recommend that you read the owner's manual before operating these units. ©1983 American Honda Motor Co., Inc.

## IT'S A HONDA

Моторист, основанный авторским проектом



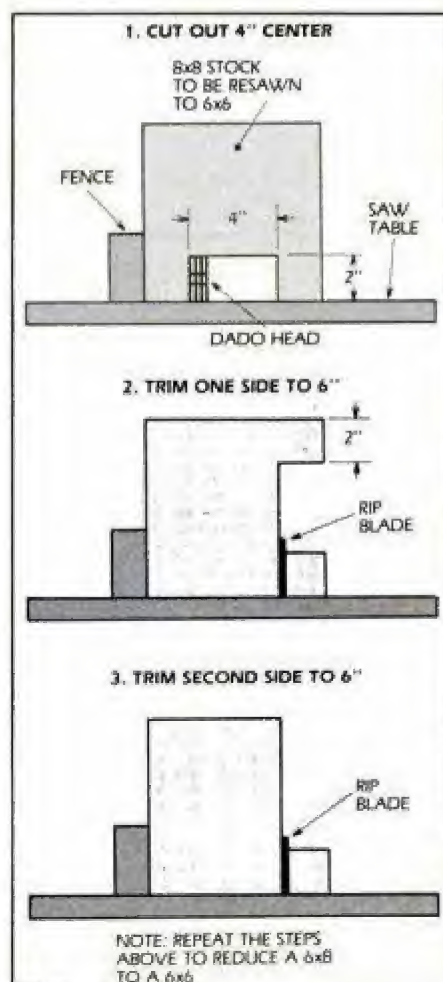
# HINTS FROM READERS

## Keeping the light

The flashlight in my car used to switch on accidentally, killing the batteries. I solved this problem by reversing the position of one of the batteries. Now, if the switch gets bumped on, the light fails to operate, thus saving the batteries.—Howard E. Moody

## Reducing large timbers

Here's my technique for cutting actual size 8x8 timbers on a table saw: 1. Use a 1/2- or 3/4-in.-wide dado head set 2 in. deep and cut out the timber's center section to within 2 in. of each side. 2. Install a rip blade, position the timber on its side and rip off the 2-in.-wide side runner. 3. Reposition the timber and rip off the remaining 2-in.-wide runner. The timber is now a 6x8. Repeat the steps to reduce it to a 6x6.—Jon Gullett



## HOMEOWNERS INSURANCE.

If you're looking for a dependable power source, it's a good policy to keep Honda's EX5500 heavy duty generator around the house.

With 5500 watts, it's ideal for main or auxiliary power. Thanks to a specially designed OHC liquid-cooled engine, it runs so much more quietly than air-cooled generators with similar output, you'll have to hear it to believe it. And it consumes up to 30% less fuel and oil.

The EX5500 also gives you the most advanced features

found on a generator today. Including an Oil/Temperature Alert system that helps prevent damage. An Automatic Idle Control for increased economy. An Automatic Voltage Regulator for steady output. And a CD Ignition for quick, reliable starts.

So whether your home is miles away from power, or you just need a strong back-up, check into the Honda EX5500. Look for your nearest Honda Generator dealer in the Yellow Pages.

**IT'S A HONDA**

For optimum performance and safety we recommend that you read the owner's manual before operating your Honda Power Product.  
© 1983 American Honda Motor Co., Inc.



# PM OWNERS REPORT:

BY MICHAEL LAMM WEST COAST EDITOR

## CHEVY CELEBRITY

"Glovebox is designed by someone who doesn't believe in gravity."

—TEXAS ENGINEER

"I can't even see the sparkplugs."

—MINNESOTA LABORER



"The paint is flawless, all panels line up and there are enough bolts to hold together."

—TEXAS OIL FOREMAN

"Make the front-seat armrest movable."

—WISCONSIN SCHOOLTEACHER

"Windows like a miniature Cadillac."

—CALIFORNIA CLUB MANAGER

PM photos: Bill Ashe

Styling and economy are first rate and it's a quality pacesetter, too.

**Y**ou can buy a stripped Celebrity, but only from the guy who stole and stripped it. Even the starkest Celebrity in your local Chevrolet showroom comes generously equipped: automatic transmission, power rack-and-pinion steering, power disc brakes, seat console with armrest, AM radio, front stabilizer bar, side-window defoggers and three dozen other standard touches. Each of them is calculated to put this newest mid-sized Chevrolet on a par with the best buys from Europe and Japan.

Chevrolet makes no bones about who's who and what's what in this very competitive core of the mid-size auto market.

The Celebrity boasts of 20 cu. ft. more total interior roominess than the



Interior design and comfort garnered high praise. Chevy managed to carve out exceptional amount of people room.

Datsun Maxima and 7 more than the Audi 5000. It has greater trunk space, say the ads, than even a Rolls-Royce—16 usable cu. ft.

The Celebrity borrows heavily from GM's X-car. It shares the Citation's basic platform, including its wheelbase, tread dimensions, and engines. Yet there's an awful lot that's not X-car—all the body panels, the suspension system, steering, engine and transaxle

mounts, and extensive sound-deadening insulation.

As in the X-car, Pontiac's injected Iron Duke Four comes standard, with a 2.8-liter, Chevy-built V6 optional. Most of our respondents opted for the V6, which delivers 112 hp against the Four's 92.

**A NATIONWIDE SURVEY  
BASED ON 2,089,488  
OWNER-DRIVEN MILES**

There's also a 4.3-liter, Oldsmobile-supplied diesel V6 available that puts out 85 horses. Chevrolet had hoped to offer the diesel V6 at the Celeb's debut in Jan. '82, but due to start-of-production problems, the division finally got it going for 1983. Partly because of this late start, the diesel accounts for only 1.6 percent of the Celebrities in our sur-

*(Please turn to page 56)*



# We've got the inside on outside protection.

Architect: Wendell Lovett, FAIA, Seattle, Washington



*Inside every can of Olympic Stain are specially treated oils that penetrate wood to give strong protection outside.*

*Inside every can is the knowledge and experience of over half a century. That's why Olympic protects the outside of more homes than any other stain.*

*And when you use Olympic outside, you'll feel a lot better inside.*

**OLYMPIC**  
Paints and Stains



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## OWNERS REPORT: CELEBRITY

(Continued from page 54)

vey, and it's not figured into our mpg data at all.

Owners seemed pleased with their cars' fuel mileage. Economy ranked No. 1 as the Celebrity's best liked feature and came in second as a reason to buy. In our survey, the Celebrity's overall fuel economy averaged 3 to 5 mpg more with the Four than the gasoline V6. The EPA numbers for the Iron Duke are 24/39, comparable to the 25/33 reported by our respondents.

The Celebrity's \$8,059 base price puts this car within reach of most buy-



Four-cylinder owners complained of inadequate power. V6 owners had no such complaint and almost the same mpg.

ers of mid-sized, five-passenger autos. It's basically the same car, by the way, as the Pontiac 6000, Olds Cutlass Ciera and Buick Century. It also competes head-on with Chrysler's E-class, Dodge's 600ES, Ford's Fairmont-based sedans, the AMC Concord and the Renault 18i.

Yet, the Celebrity costs many thousands less than such European sport/luxury sedans as the BMW 528e, Volvo 760, Audi 5000 and so on. Most of the owners we surveyed paid around \$10,000, and several mentioned GM's 12.8 percent financing promotion as a purchasing goad.

According to the owners we surveyed, though, it was styling, not price or interest rates, that brought customers into Chevy dealerships initially.

"I fell in love with the Celebrity's new shape and design the first time I saw it," glowed a California club manager. The car rides like a miniature Cadillac; it seems to glide down the road. Acceleration is excellent and rear legroom is unbelievable."

An Illinois word processor put it this way: "I'm very impressed with my Celebrity. I find the performance [of the four-cylinder engine] more than satisfactory. Better than that, I'm getting 33 mpg in town! This car has given me no mechanical troubles at all and its ride is truly smooth for a smallish sedan."

A California medical technician: "The fuel-injected, four-cylinder engine has all the power I need. I drive a lot on mountain roads and the front-

wheel-drive Celebrity handles great. It's a small car but has lots of room inside; good ride and very quiet."

Nearly everyone conceded that the Celebrity excelled in the silence and smoothness of its ride. Where it didn't excel, though, was in negotiating harsh bumps and potholes. A Michigan die-maker wasn't alone when he grimaced, "The standard suspension seems to be very short on spring travel. The car bottoms out easily on rough roads."

Chevrolet does offer two heavier duty suspension options: RPO F40 (\$22) and F41 (\$41) for towing and sportier handling, respectively. But not too many owners have them.

Even so, a Wisconsin secretary represented the majority when she wrote, "I like the way the Celebrity rides and handles. It's very maneuverable—small-car maneuverability in a car that doesn't look or feel small."

Workmanship received commendable marks, too. Nearly 80 percent rated the Celebrity's workmanship and overall quality *good to excellent*. A Texas oil foreman pointed out, "Flawless paint, all panels line up and the car has enough bolts to hold itself together."

A Minnesota laborer commented, "The Celebrity keeps living up to my expectations in every way, including quality. But it's hard to work on. I can't even see the sparkplugs."

An Illinois electrician: "My car cost \$12,618 and here I am, stuck with a set of plastic wheelcovers." And a Nebraska weather officer concurred: "Acceptable workmanship, but there's an awful lot of plastic on this car."

When we asked about interior comfort, 8.3 percent of the drivers we interviewed mentioned the fixed center armrest on the Celebrity's standard interior. "I wish they'd make the front-



The wide, flat trunk has acres of space. This car can take a family and their luggage on vacation without a big fuel bill.

seat armrest movable," suggested a Wisconsin schoolteacher. As it is, all models except those with standard interior have movable armrests.

As for suggested changes, a Minnesota trucker would like a full bench seat up front, *without* the center armrest.

(Please turn to page 58)

## ESCORT:

By now, just about everyone knows a radar detector needs *lots* of warning distance to be truly effective. And ESCORT® delivers. Over hills, around corners, and from behind. *Car and Driver* magazine, in their 1982 test, went so far as to say: "The ESCORT, a perennial favorite of these black-box comparisons, is still the best radar detector money can buy." But there's more to the story.

### The Plot Thickens

About a year ago, all radar detectors began picking up a new type of radar signal that was as strong as some police radars. The rest of the radar detector industry dismissed these signals as unmarked patrol cars, radar intrusion alarms, or even overactive imaginations.

But something didn't add up. There were just too many of these new signals. And we had another clue. ESCORT's audio warning distinguishes between the two police radar bands: it "beeps" for X band, and "braps" for K band. These new radar signals simultaneously triggered *both* warnings, and that told us the signals couldn't be police radar. Tracking down a car emitting this signal revealed the actual source—a new type of imported radar detector had the side-effect of *transmitting* radar signals in both police radar bands. Hard to believe, but true.



Our first step was to inform ESCORT owners of the situation. We composed a "Radar Bulletin" explaining the source of this new radar pollution and sent out 200,000 by first class mail. But this was only the beginning.

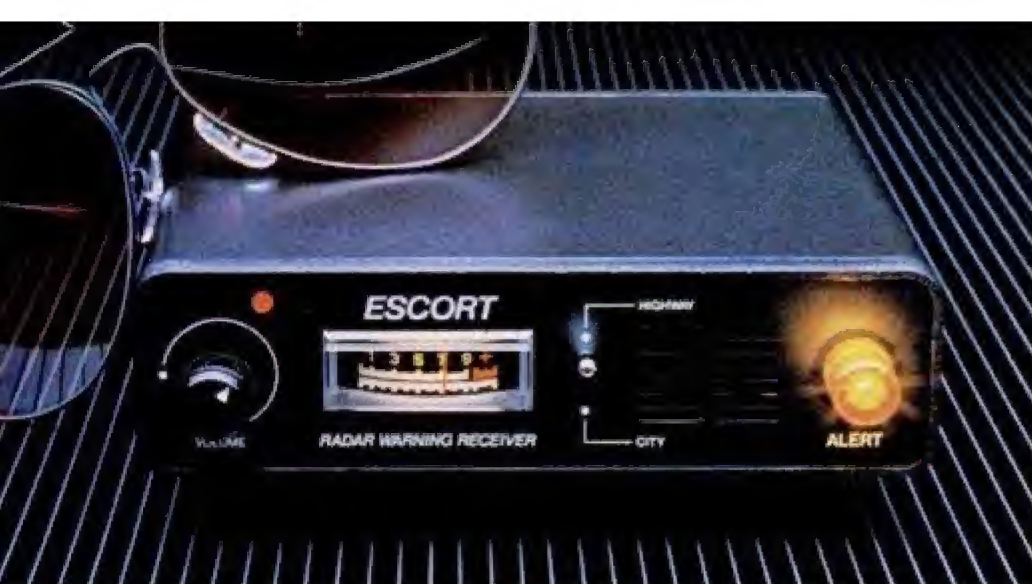
### Mission Impossible?

On the surface, the problem seems unsolvable. The signals transmitted by these "radar polluters" are in the same bands as police radar, so it's impossible to detect one and ignore the other, right?

## FOR ESCORT OWNERS ONLY:

As our ad above states, we've made another improvement. The new ST/O/P circuitry is a standard part of every ESCORT starting with serial number 400,000.





The Radar Defense Kit

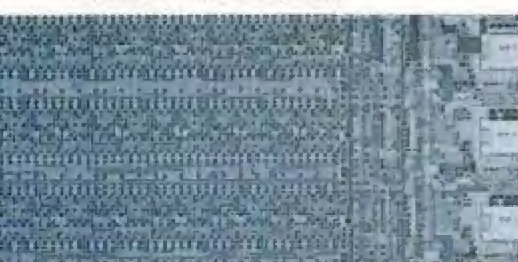
# Radar Warning, No Riddles.

Not necessarily. Let's look at another type of technology to make a point. You can now buy an inexpensive device that will turn on the lights in your living room whenever you clap your hands. Or shout. Or drop a book. Or make any loud sound. At the other extreme, there are computerized devices available that don't merely sense sound, but can actually recognize sound patterns unique to specific spoken words. Some can even tell your voice from any other.

Why not apply this principle to radar detection? Instead of merely acknowledging the presence of any radar signal, a detector could look for a pattern in the signal and distinguish between "radar polluters" and actual police radar. And now ESCORT does just that.

## Nothing But The Truth

The result of months of extensive engineering, ESCORT's new ST/O/P™ circuitry reduces alarms from "radar polluters" by over 95%. ST/O/P (Statistical Operations Processor) consists of a CMOS digital processor with built-in memory. When ESCORT receives an X or K band radar signal, ST/O/P recognizes patterns in the signal's amplitude/frequency/time characteristics, and uses these patterns to determine the signal's identity. All in 1/64 of a second.



If the signal is from a "polluting detector," ESCORT keeps quiet while maintaining its lookout for police radar. If the signal is police radar, ESCORT immediately alerts you. And unlike other detectors that keep you guessing, ESCORT's amber warning lamp, signal strength meter, and geiger-counter-like pulsing sounds ("beeps" or "braps") tell you *everything* you need to know. ESCORT has a lot to say, and we include a 33 1/3 RPM Radar Disc to make getting acquainted easier than ever. Play it on your stereo turntable and take a "test drive" with ESCORT as soon as you open the box.

## Fully Equipped

ST/O/P digital circuitry is just the latest example of the continuous development of the ESCORT. We won't compromise on performance or features. Here's proof:

- Patented Digital Signal Processor
- Different Audio Alerts for X or K Band Radar
- Varactor-Tuned Gunn Oscillator tunes out false alarms
- Alert Lamp dims photoelectrically after dark
- 1/64 Second Response Time covers all radar
- City/Highway Switch filters out distractions
- Audio Pulse Rate accurately relates radar intensity
- Fully Adjustable Audio Volume
- Softly illuminated Signal Strength Meter
- L.E.D. Power-On Indicator
- Sturdy Extruded Aluminum Housing
- Inconspicuous size (1.5H x 5.25W x 5D)
- Power Cord Quick-Disconnect from back of unit
- Convenient Visor Clip or Hook and Loop Mounting
- Protective Molded Carrying Case
- Handy Cigar Lighter Power Connection
- Spare Fuse and Alert Lamp Bulb.



Take a stereo "test drive."

## Critics' Corner

*Car and Driver:* "...All things considered, the ESCORT is the best piece of electronic protection on the market."

*BMWCCA Roundel:* "...The ESCORT is a highly sophisticated and sensitive detector that has been steadily improved over the years without changing those features that made it a success in the first place... In terms of what all it does, nothing else comes close."

*Playboy:* "...ESCORT radar detectors...[are] generally acknowledged to be the finest, most sensitive, most uncompromising effort at high technology in the field."

*Autoweek:* "...the consistent quality is remarkable."

## Made In Cincinnati

If you want the best, there's no reason to look anywhere else. ESCORT is designed and manufactured under one roof, and sold to you factory direct.

Knowledgeable support and professional service are only a phone call or parcel delivery away. And you can try ESCORT at *no risk*. Open the box, play the Radar Disc, and install your ESCORT. Take 30 days to test it. If you're not absolutely satisfied, we'll refund your purchase and pay for the postage costs to return it. You can't lose. We also back ESCORT with a full one year limited warranty on both parts and labor. ESCORT will change radar for you forever. So order today.

## Do It Today

Ordering an ESCORT is simple, by mail or by phone.

**By Phone:** Call us toll free. A member of our sales staff will be glad to answer any questions and take your order. (Please have your Visa or MasterCard at hand when you call).

**CALL TOLL FREE... 800-543-1608**  
**IN OHIO CALL... 800-582-2696**

**By Mail:** We'll need to know your name and street address, daytime phone number, and how many ESCORTs you want. Please enclose a check, money order, or the card number and expiration date from your Visa or MasterCard.



**ESCORT (Includes Everything)... \$245.00**  
Ohio residents add \$13.48 sales tax.

## Speedy Delivery

If you order with a bank check, money order, credit card, or wire transfer, your order is processed for shipment immediately. Personal or company checks require an additional 18 days.

**ESCORT**  
**RADAR WARNING RECEIVER**

Cincinnati Microwave  
Department 568  
One Microwave Plaza  
Cincinnati, Ohio 45242

Is ST/O/P adaptable to your present ESCORT? Well, yes and no. At S.N. 200,000, there was an internal redesign of ESCORT incorporating custom integrated circuitry, a precision quartz timebase, and a new integrated microwave mixer/antenna/Gunn oscillator. The new ST/O/P technology builds on this by signifi-

cantly expanding the digital logic and adding memory. As a result, older units (serial numbers less than 200,000) cannot be modified to incorporate ST/O/P technology.

For those of you with ESCORTs from S.N. 200,000 to 399,999 we are presently developing procedures and

facilities to make adding the ST/O/P circuitry to your unit possible. The cost will be \$75, and details and special shipping instructions will be in our advertisement in the August '83 issue of this magazine. Sorry, but we won't be able to convert your unit until that announcement.



## OWNERS REPORT: CELEBRITY

(Continued from page 56)

And a Massachusetts banker told us he'd appreciate a five-speed manual gearbox, even if he had to pay extra.

Several respondents said they wish Chevrolet had offered the Celebrity as a

station wagon—something Chevy hoped to do by 1983, but didn't make it. As you can see, a majority of owners had plenty of good things to say about the Celebrity. A New York attorney testified: "This Celebrity's handling is almost like a sports car. Yet there's room for five adults plus luggage, and

no one's cramped in the rear seat."

A Wisconsin roofing contractor: "I'm pleased with the Celebrity's quality, which is surprising after so many years of poor U.S. workmanship."

And an electrical engineer from Ohio summed it up by smiling, "It's the best car I've ever owned." **PM**

## SUMMARY OF 1982-83 CHEVROLET CELEBRITY OWNERS REPORTS\*

<b>Total miles driven</b> 2,089,488	<b>Styling</b> ..... 38.2	<b>Comfort opinion (front seats):</b>	<b>Dealer service opinion:</b>
	<b>Ride</b> ..... 30.1	Excellent ..... 60.4%	Excellent ..... 30.9%
<b>Average miles per gallon:</b>		Good ..... 36.7	Good ..... 40.5
<b>OHV Four</b>	<b>Specific dislikes:</b>	Average ..... 2.1	Average ..... 17.1
In town ..... 25.0	No complaints ..... 27.1%	Poor ..... 0.9	Poor ..... 11.5
On the highway ..... 32.6	Not enough horsepower ..... 7.8		
<b>OHV V6</b>	Poor workmanship ..... 6.5		
In town ..... 21.9	Poor materials ..... 5.9	<b>Comfort opinion (rear seats):</b>	<b>Number of vehicles owned:</b>
On the highway ..... 27.6	Rattles and noises ..... 4.6	Excellent ..... 45.3%	This car only ..... 48.1%
		Good ..... 47.5	Two cars ..... 41.3
<b>Engine choices:</b>	<b>What changes would you like?</b>	Average ..... 6.3	Three cars ..... 8.8
OHV 2.5-liter Four ..... 46.9%	No changes ..... 14.2%	Poor ..... 0.9	Four or more cars ..... 1.8
Gasoline 2.8-liter V6 ..... 51.9	Bigger glovebox ..... 9.6		
Diesel 4.3-liter V6 ..... 1.2	Movable center armrest ..... 9.2	<b>Had any mechanical trouble?</b>	<b>Makes of other cars owned:</b>
	Better materials ..... 8.3	No ..... 60.3%	Chevrolet ..... 42.5%
<b>Body style:</b>	Firmer suspension system ..... 6.3	Yes ..... 39.7	Ford ..... 24.1
Four-door sedan ..... 76.5%			Pontiac ..... 8.6
Two-door sedan ..... 23.5	<b>How much did you pay?</b>		Oldsmobile ..... 8.0
	Under \$8,500 ..... 8.1%	<b>What type of trouble?</b>	<b>Age distribution of owners:</b>
<b>Why did you choose this car?</b>	\$8,501 to \$9,500 ..... 25.3	Air conditioner ..... 15.6%	15-29 years ..... 11.4%
Styling ..... 41.9%	\$9,501 to \$10,500 ..... 39.3	Transmission ..... 14.8	30-49 years ..... 38.1
Economy ..... 36.2	\$10,501 to \$11,500 ..... 18.9	Power steering leaks ..... 9.6	50-plus ..... 50.4
Size ..... 25.4	\$11,501 to \$12,500 ..... 6.8	Oil leaks ..... 8.9	
Front-wheel drive ..... 22.8	More than \$12,500 ..... 1.6	Fuel induction ..... 6.7	<b>Would you buy another Chevrolet?</b>
Roominess ..... 13.2		Electrical system ..... 6.7	Yes ..... 87.6%
	<b>Workmanship opinion:</b>	Brakes ..... 6.7	No ..... 12.4
<b>Specific likes:</b>	Excellent ..... 26.8%	<b>Dealer repairs satisfactory?</b>	<b>Would you buy another Celebrity?</b>
Economy ..... 52.4%	Good ..... 53.0	Yes ..... 59.2%	Yes ..... 82.4%
Handling ..... 45.8	Average ..... 13.7	No ..... 40.8	No ..... 17.6
Comfort ..... 40.1	Poor ..... 6.5		

\*Percentages might not equal 100% due to rounding or insufficient data.

# There are two rechargeable lights in this picture.



## The one that's still shining is Ready-Lite.

There are two well-known brands of rechargeable light. But the difference between them is like night and day.

Ready-Lite shines more than 2½ hours on a single charge. The other light can't.

Ready-Lite stands on its own and swivels its beam to put light where you want it, and to leave your hands free. The other light doesn't.

Ready-Lite can switch from a wide beam to a narrow, focused beam. The other light can't.

And Ready-Lite will hang on to its power, ready for emergencies, even if you don't turn it on for months. The other light may not.

The other light can't match Ready-Lite.



**READY-LITE™**  
From the makers of **First Alert®**



© 1983 Mobil Oil Corporation

**\$1.50 Manufacturer Rebate**  
on purchase of 5 quarts of Mobil 1,  
Super 10W-40, Special 10W-30 or Heavy Duty  
motor oils. (May 1-June 4, 1983)

100% Synthetic Motor Oil  
Saves you gas and oil changes



**Mobil 1**

If you're not using Mobil 1® you could be shortchanging your engine.

Mobil 1's unique molecular structure is the reason it lubricates better and helps protect engine parts better against friction and wear than conventional oil. So engines stay cleaner and run smoother.

Mobil 1's molecular structure is also the reason it saves gas compared to conventional oil, helps you start at 35°F below and takes you 25,000 miles\* (or one year which-ever comes first) between oil changes.

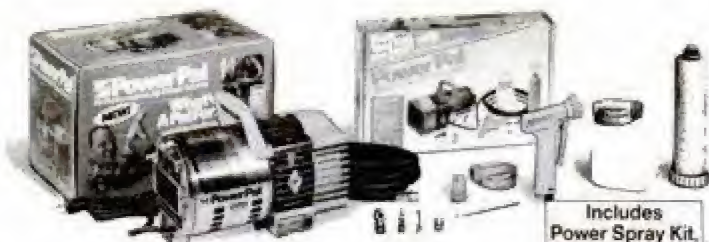
Start treating the inside of your car as well as you treat the outside. It doesn't take a lot of effort, just a little Mobil 1.

Add oil as needed. New car owners follow warranty instructions. Diesel owners follow manufacturer's instructions.

**Mobil 1. The oil that saves you gas. And more.**

**Treat the inside  
of your car as well as you  
treat the outside.**

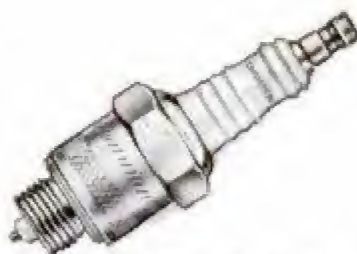




Includes  
Power Spray Kit,  
\$30 value FREE!

**CAMPBELL HAUSFELD® Power Pal Compressor** combines powerful 1/2 HP motor with maintenance-free, oil-less 2-cylinder pump. Adjusts from 10 to 100 PSI at the twist of a dial. Lightweight, portable with 6' cord and 15' air hose. Buy now, get \$30.00 value Power Spray Kit FREE. MA4105

**139<sup>99</sup>**



**CHAMPION® Spark Plugs.** Time to replace worn plugs for better gas mileage, smoother running engine. Regular plugs, ea . . . . . **99¢**  
Resistor-type, ea . . . . . **1.15**



All other Fram filters are on sale!

**FRAM® Filter Values.** Great savings that prevent sludge build-up and prolong your engine's life. Air filters. CA326/351/303/327 . . . . . **3.99**  
Oil filter. PH8A/25/30/43 . . . . . **2.99**



**Keep your car running in top form with these values, specially priced through June 4 only.**

# Winning

from more than 6,000 True Value Hardware Stores and Home Centers throughout 50 states. Look under "Hardware" in the Yellow Pages.



**GUNK® Grease Cleaner** removes grease and oil from barbecues, floors and lawn mowers. Just spray on and rinse off. 16-oz. FG1 . . . . . **1.89**  
**Engine Brite.** 16-oz. spray. EB1 . . . **1.89**

**UNION CARBIDE® Prestone® Sealer and Stop Leak** helps stop cooling system seepage. 12-oz. AS121 . . . **1.29**  
Anti-Rust water pump lubricant protects seals. 12-oz. AS111 . . . . . **1.29**



**TEXACO® HAVOLINE Supreme** all-climate motor oil protects engines at high and low temperatures. 10W40-QT. 1814

**99¢**

**VALVOLINE® Motor Oil** for all-climate, heavy-duty engine protection against wear, rust and carbon. 10W40-QT. 141

**99¢**

**QUAKER STATE® Deluxe Motor Oil** helps engine run smooth and efficiently. 10W40-QT.

**1.09**



**GOLD EAGLE® Air & Repair Tire Inflator and Sealant** with universal fit hose and valve. Ideal for cars, trucks, motorcycles, bicycles. Won't affect tire balance or wheel alignment. 12-oz. TIH

**1.99**

**TRI-FLOW® Aerosol Lubricant** with Teflon reduces friction, shields metals against rust and corrosion, frees frozen mechanisms fast. 3 oz. 13000

**1.99**

**ARMOR ALL® Protectant** beautifies vinyl, rubber, plastic and leather. For home, car, boat. 16-oz. 10160 . . . . . **4.99**  
Cleaner for most surfaces. 16-oz. 30160 . . . . . **1.89**



**BONDO® Dent Puller** reduces depth to bring dent closer to contour and save on plastic body filler. 953 . . . . . **6.99**  
Body Filler. 261-Pt . . . . . **1.99**



**WD-40® Lubricant** penetrates instantly to free frozen metal parts, stop rust and corrosion. Stops squeaks. 9-oz. spray. 40011

**1.49**



**STP® Foaming Engine Degreaser** is the no-mess way to dissolve dirt and grime on your engine. 0921 . . . . . **1.99**  
Oil Treatment, 15-oz. 1015 . . . . . **1.89**



**LUBRIMATIC® Grease Gun** has up to 10,000 lbs. working pressure to lubricate cars and trucks easily. 7090 . . . . . **7.99**  
14-oz. Grease Tube. 400 . . . . . **1.19**





**GENERAL ELECTRIC® Halogen Plus® Sealed Beam Headlights** give more light from the same number of watts. Available in a wide range of either round or rectangular sizes. Easy to install yourself. Hi or low beam. H5006/H4001/H4655/H4651 Pair . . . . . **7.99**  
Hi/low combination. H6014/H6054 Pair . . . . . **14.99**

**BLAZER® Halogen Quartz Lamps** penetrate fog, rain or snow. Wiring and switch included. Choice of amber or clear. BB41/43CD Pair, **24.99**

**TRU-TEST® X-O Rust®** seals out air and moisture, stops old rust from spreading and keeps new rust from forming. Qt. . . . . **4.98**  
Convenient Spray. 16 fl. oz. . . . . **2.78**

# Values



**George Bignotti, master mechanic to a record number of six Indy winners...**  
"To take on the toughest competitors in the most grueling race demands superior strength and precision performance. That's why I use Master Mechanic® tools and accessories sold exclusively by True Value Hardware Stores and Home Centers."



**MASTER MECHANIC® Tool Chests** feature solid steel "strongbox" construction, enamel finish, smooth compound drawer glides, full-length hinge. With keyed cylinder locks. 6-drawer chest, lift out tray 15x26x13½" MM1806 . . . . . **94.50**  
3-drawer roller cabinet. 33½x26½x18" MM1903 . . . . . **121.50**

**MASTER MECHANIC® 10-Gal. Wet/Dry Vac** picks up everything! Has a high performance by-pass motor for extra cleaning power. 30° angle motor housing prevents tipping, airflow control on curved wand adjusts suction. With tool set. MMP800-10 **62.99**

**MASTER MECHANIC® Oxy-Propane Torch** has 2 fuels, dual controls up to 5,000°. Cut, weld, braze and solder. Lightweight, portable. MMW5000 **32.99**

**MASTER MECHANIC® 40-pc. Tap and Die Set** with tempered steel edges cuts NC, NF, NPT threads. Tap and t-handle wrenches, thread gauge, etc. 442657 **44.99**

**MASTER MECHANIC® 7" Diagonal Pliers** forged from tough alloy tool steel. Cutter is electronically hardened. Forged rivet for precise fit. MM40-7C **6.99**

**MASTER MECHANIC® 8-pc. Screwdriver Set** handles all jobs with 5 slotted and 3 Phillips tips. Precision ground blades, high impact handles. TT8 **7.49**



5.99  
-1.00 rebate  
4.99 final cost



**LOCTITE® Rear View Mirror Adhesive** permanently bonds mirror to windshield. 11067 . . . **1.89**  
Auto Trim Adhesive for emblems, moldings. 00215 . . . . . **1.89**

**MEGUIAR'S® Fast Finish®** gives car a long-lasting shine. 14-oz. paste, 18-oz. spray, or 16-oz. liquid. Each **5.99** less \$1 manufacturer rebate. A1814/19/16

**TURTLE WAX® PolyShell® Sealant** cleans, shines, protects in 1 step. 16-oz. liquid, 18-oz. spray, or 13-oz. paste. T560/70/65 Each **4.88**

**DURACRAFT® Impact Driver** easily loosens screws. ¾" drive with 2 slotted, 2 Phillips bits and adapter in steel box. 2500 **4.29**

Because participating True Value Hardware Stores and Home Centers vary in size and merchandising policies, some may not stock all items shown. Prices may vary and are subject to change without notice. Prices expire June 4, 1993.

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# PM SOFTWARE MONITOR



## An extremely powerful database runs on most computers



The dBase II lists contents of database (left) and designs format for one (right).

A program called *dBase II* from Ashton-Tate has impressed us as being the Rolls-Royce of computer databases. If you need a database which will do more than just keep your address book or a list of client numbers, this one's for you. It will do everything you've ever imagined a database would do.

Like other databases, it allows you to

define your own *fields* within a *record*. If your records are inventory readouts, for example, one field might be quantity on hand and another quantity on order. Or, if you have records concerning monthly bills, one field might be creditor's name and another amount owed and a third bills paid. A universal database like *dBase II* allows you

to keep track of virtually everything.

The *dBase II* will help you sort your information by multiple categories. And it will retrieve records by looking for whatever information to match up to that you might wish. Of course, it will print out a report complete with automatic calculations.

But *dBase II* is also a programming language—a database language. You can use its command file capability to write your own programs. These programs can save you many keystrokes during data entry—or guide a person who has never seen a computer in the operation of your home or office database. The command sets let you do such things as put menus (screenfuls) of choices onscreen, read information direct from disc and more.

At \$700, *dBase II* is not for the casual user. But if you need a serious database and have a CP/M-capable computer, this is a great way to go.—*N.S.*



## Muppet madness

Nothing in the world delights kids more than a computer game that they can play by themselves. And this new *Mix And Match* game from Apple Computer and Children's Television Workshop is such a real pleasure.

Preschoolers use the game controls on the Apple to choose various parts of different, popular Muppets. They can make their own Muppets. We show Ernie's smiling face atop Big Bird's feet on Cookie Monster's torso (above). That's only one of the many hilarious cartoons that can be created by the preschooler. Even though \$50 is a heavy hit, the laughs make it worthwhile. —N.S.

## The best in chess

The game of chess has been programmed many times for just about every personal computer system. But this new program, *Chess* (\$69.95) from Odesta Software for the Apple II and Atari 800 machines, is the next best thing to playing a cunning human teacher.

The computer will do such things as give you advice, rate the present position, show what its plans are for the next few moves, store game positions on disc, rerun stored games like a chess "movie," show the squares a particular

unit is attacking, and call out what enemy pieces are attacking each of your men. It will even let you play three varieties of "blind" chess where the pieces are blank triangles instead of chessmen, or are hidden from view.

All of the options make playing a game with *Chess* more like having a conversation with a chess teacher than playing against a machine. In an article about chess programs and machines later in the year, *Chess* will be examined in detail. For now, let's just say that if you want the game of kings on your computer, this is a kingly version. —N.S.

Chess program shows attacked squares (left) and the computer's potential moves.



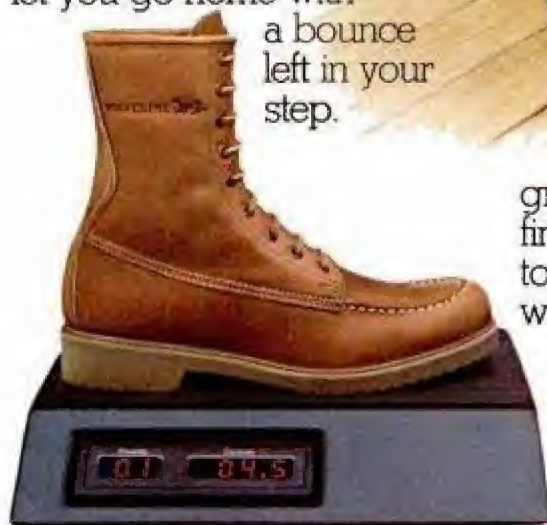


# THE LIGHTER YOUR BOOTS THE LONGER YOU'LL LAST.

Take a load off  
your feet.

Until now, the only way you could tell if your boot was tough enough to take a long hard day of work was to buy the heaviest boot you could find. It got the job done, but it also left you tired from your head to your toes. That's why we built a whole new line of heavy-duty, yet lightweight boots called *Work-Lites*.™ Boots tough enough to take it, but comfortable enough to let you go home with

a bounce  
left in your  
step.



Electronic digital scale shows actual weight, accurate to 1/10 ounce.

We couldn't make  
them tougher, so we  
made them lighter.

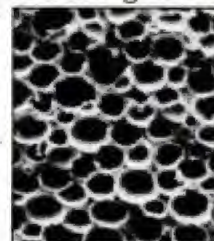
Our work boots have  
always been known for  
toughness. That's because  
we start with the finest, full

grained cowhide we can  
find, and specially treat it  
to resist everything from  
water to acid.

We couldn't make them  
any tougher. So instead,  
we've made them a lot  
lighter by using the  
same super tough sole  
material we use in our  
heavy-duty hiking boots.  
These Powerthane™ soles  
are up to 55% lighter,  
and still give you all the  
abrasion resistance,  
slip resistance and  
long tread life  
you need.

The sole difference  
is comfort.

The microcellular composition of our sole material is what makes the difference. In a microscopic view, you can see that the material is permeated with airholes that lighten its weight while also helping to absorb shock. In effect, you're walking on a cushion of air. And, the result is a perfect combination of dependable toughness and incredible comfort.



Microscopic View

Boots that live up  
to their name.

When you make boots for  
people who wear them  
to make their living, like  
we've been doing for over  
75 years, you learn a thing  
or two.

You learn to make boots  
that look good, feel good,  
and last a good long  
time. And, you learn not  
to put your name on  
anything less.



**WOLVERINE®**  
**Boots & Shoes**



# If you smoke...

you should know that many smokers who are looking for a cigarette that offers smoking pleasure and ultra low tar have made today's Carlton their No. 1 choice.

In fact, Carlton is America's most popular, best selling ultra low tar brand.

Latest U.S. Government Report—Carlton King, Menthol or Box 100's—**10 packs of Carlton have less tar than 1 pack of the following brands:**

	TAR mg/cig	NICOTINE mg/cig		TAR mg/cig	NICOTINE mg/cig
Kent	12	1.0	Kent 100's	14	1.2
Winston Lights	11	0.9	Winston Lights 100's	12	0.9
Marlboro	16	1.0	Benson & Hedges 100's	16	1.1
Salem	14	1.1	Parliament Lights 100's	12	0.9
Kool Milds	11	0.9	Salem 100's	15	1.1
Newport	16	1.2	Marlboro 100's	16	1.1
Carlton Kings	Less than 0.5	0.1	Carlton Box 100's	Less than 0.5	0.1
Carlton Menthol	Less than 0.5	0.1			



Box King—lowest of all brands—less than 0.01 mg. tar, 0.002 mg. nic.

## Carlton is lowest.



Warning: The Surgeon General Has Determined That Cigarette Smoking Is Dangerous to Your Health.

Box: Less than 0.5 mg. "tar", 0.05 mg. nicotine; Soft Pack, Menthol and 100's Box: Less than 0.5 mg. "tar", 0.1 mg. nicotine; 100's Menthol: 3 mg. "tar", 0.3 mg. nicotine; 100's Soft Pack: 4 mg. "tar", 0.4 mg. nicotine av. per cigarette, FTC Report Dec. '81.



# THE PM GARAGE



## Packaged brakes

In a master stroke of clever packaging, Rally Manufacturing has just introduced a series of brake job kits that are designed specifically for the weekend mechanic.

The disc brake replacement kits come packaged in a plastic tray with a transparent top and include the pads, antisqueal compound, lubricant and pin boots—in short, everything you'll need to do a brake job except the hand tools.

Each kit is specifically designed for a particular car and model year and any unique part of that model is included. We did a brake job on a Mustang and the kit was faithful to its word in providing everything needed to do the job.

Brake job kits are available for most popular American and some import cars.

Prices vary according to application but are competitive with most boxed



**Complete brake-job kit has everything you need to do job right the first time.**

brake pads, considering the extras you get.

Rally Manufacturing is located at 8040 Northwest 33rd, Miami, Fla. 33122.—T.A.

## Instant threads

Like a blind riveting tool, the Nutter lets you fasten parts when you can't reach behind a body panel to install a nut. But unlike the blind riveter, the Nutter uses a threaded rivet that accepts an ordinary machine screw, letting you as-



**Rivet tool can install a threaded rivet as well as conventional blind rivets.**

semble and disassemble your work. The Nutter, case and a good supply of threaded rivets in various sizes is \$39.99.

It's from DRI Industries, 11100 Hampshire Ave. S., Bloomington, Minn. 55438.—Bob Berger

## Snow chain-ger



**Chain storage box top doubles as installation ramp. It handles 2,000-pound load.**

Last winter I solved my snow-chain storage and installation problem—with the Chains-Away combination storage box and installation ramp. The box can hold a pair of chains with room left over for gloves and hand tools. The top of the box is an installation ramp, too. It holds up to 2,000 pounds, suitable for most cars and pickup trucks. To install the chains, lay the cover and drive onto the cover/ramp. It's about \$15. Contact Wink Corp., 20630 56th Ave. W., Lynwood, Wash. 98036.—Joel Breault

## Little lantern, lots o' light

Though only a tad over six inches long, this fluorescent lantern is a potent performer, boasting an ultrawide 300° beam. That big splash of light came in handy one evening when I had to play hide-and-seek with a bolt I dropped while making some roadside repairs. Four AA cells provide power; I use rechargeable NiCds in mine. The lantern, minus batteries, is \$14.95 from Early Winters, 110 Prefontaine Place S., Seattle, Wash. 98104.

—Bob Berger



**Design of powerful light has won it a permanent home in Museum of Modern Art.**

## A ripping yarn



**Seat-patch kit can repair virtually any type and color of vinyl seat or top.**

The next time you gash your car's seat, reach for the Magna-Weld vinyl repair kit. It comes with 20 jars of colored repair compound, a color-matching card, a heating element, grained sheets, a mold to duplicate the grain of your existing vinyl (if none of the sheets match), clear vinyl cleaner and clear instructions. The kit costs \$39.95 plus \$2.75 for shipping from Magna Sales Co., 2017 West Montrose Ave., Chicago, Ill. 60618.—Joel Breault



# PM OWNERS REPORT: FORD RANGER

BY MICHAEL LAMM WEST COAST EDITOR

*"I'm impressed with the ruggedness of the 2.0 engine."*

NORTH CAROLINA FARMER

*"It's built like a full-size pickup."*

MINNESOTA ELECTRICAL TECHNICIAN

*"I'd like more low-end power."*

TENNESSEE BUS DRIVER

*"Workers take great pride in assembly, no sloppiness."*

IOWA SALESMAN



*"It's hard to get into third gear."*

KENTUCKY FACTORY WORKER

PM photos: Bill Ashe

Economy, compact size attracted owners, but the quality keeps them happy.

If you compare the Ranger's base price with that of Ford's least expensive full-sized pickup, the F-100, you'll discover the main reason people buy this little truck. Next, check what Chevrolet asks for the S-10 and that also helps clinch the deal.

The bare-bones Ranger stickers out at \$5,993. The F-100 goes for \$6,909, and the S-10 rolls out the door for \$6,343.

Add to that the fact that the Ranger gets up to 28.9 mpg on the highway (actual, not EPA) and you can see why economy ranks No. 1 with the Ford Ranger owners we surveyed from all parts of the country.

Second came size; third was styling. Ford calls the Ranger a mid-sized pickup. Yet the Ranger stands about three inches shorter than the Mazda-built Courier it replaced. The Ranger does look bigger than it is, more like a scaled-down version of Ford's F-series pickups. And true to the Ford truck tradition, the Ranger has twin-I-beam front suspension.

So there's no doubt that size, perceived or real, accounts for a good measure of the Ranger's appeal. So does its little brother, styling. But more significant than economy, size or styling is a trend the Ranger shows in this Owners Report—the trend back to American-made vehicles. This swing appears to involve not only the Ranger but a lot of recent U.S.-built cars. It's based on favorable quality comparisons between domestic and imported cars and trucks.

## A NATIONWIDE SURVEY BASED ON 2,045,167 OWNER-DRIVEN MILES

Judging by the owners who responded to our Ranger survey, Ford quality has taken a big upward jump in recent years. True quality in an American-made pickup certainly seems to have impressed a majority of the owners who have driven and researched vehicles from both sides of the Pacific.

For example, a Kansas military officer wrote on his questionnaire: "I've always wanted to buy American, but in the past there have been only foreign small pickups to choose from. After keeping an eye on the import market

(Please turn to page 69)





# FRESH AIR BREAKTHROUGH!

**AMERICA'S NEWEST AND MOST POWERFUL BIPOLAR IONIZING-PRECIPITATOR CLEANS YOUR AIR OF HARMFUL, IRRITATING POLLUTANTS BETTER THAN ANY OTHER ROOM IONIZER.**

**IF YOU WANT CLEAN FRESH AIR OR YOU'VE UNPLUGGED YOUR POPULAR FILTER-FAN UNIT BECAUSE IT DOESN'T WORK THEN READ THIS...**

Is your indoor air fresh, clean and alive? Indoor air pollution is becoming a national health hazard. Energy efficient airtight buildings are stifled with stale polluted air which contains tobacco smoke, smoke and soot from fireplaces, heating systems and cooking appliances, as well as dust, pollen, viruses, and bacteria. Most of these pollutants are so small (under 5 microns) that they are not effectively removed by common small filter-fan units. Scientific tests show that these noisy toy-like devices which emit chemical "citrus" odors are no match for high-powered ionizers in thoroughly cleaning indoor air.

## ANOTHER IMPORTANT DIFFERENCE

You know how fresh and vibrant the air feels right after a rainstorm, in the mountains, or near a waterfall. That clean, alive fresh air is rich in something important that is greatly depleted in our urban and indoor air. That missing element is negative ions, nature's own air cleaners. Many users experience great benefit from these amazing active ions, including feelings of aliveness, alertness and vitality similar to that experienced in the fresh mountain air. In addition, even hospitals use ionizers in some units.

Filter fan units do not emit negative ions. The COLLECTOR, by Zestron, creates trillions of these beneficial ions every second, while giving you the best performance, value and technology in air cleaning.

## THE ZESTRON BREAKTHROUGH!

Most ionizers clean your air but leave an untidy deposit of pollutants on room and furniture surfaces near the ionizer. The COLLECTOR by Zestron takes ion technology a giant step forward by giving you super-powered ion output while depositing pollutants from your air on the collector panel. This easy to clean panel features a scientifically formulated surface that electrostatically attracts the vast majority of airborne pollutants to it rather than to the floor or walls near the ionizer. Other bipolar ionizers with porous collecting surfaces that absorb odors and unsightly grime are almost impossible to clean.

## AMAZING DEMONSTRATION!

Unplug your COLLECTOR, place the ionizer unit and an ash tray on top of the panel. Place a lit cigarette in the ash tray and watch the smoke rise into the air. Now plug it in, and amaze yourself and friends as the smoke barely rises above the ash tray and then nose-dives onto the collector panel before it can enter the room air. This is accomplished entirely electronically with no moving parts! The COLLECTOR by Zestron is the only ionizer on the market that cleans the air powerfully enough to accomplish this test.

## ADJUSTABLE OUTPUT

Some people prefer fewer ions at night. The COLLECTOR is the only adjustable bipolar ionizer that allows you to set the ion level to your personal preference.

## THOUSANDS OF SATISFIED USERS

Don't you, your family and friends deserve the healthy clean fresh air that Zestron ionizers have brought to thousands of satisfied users? Users write: "I simply can not believe how much better I feel!" Dr. E.K., DDS—MA; "I smoke heavily and it has cleared the air as advertised" G.R.—WA; "I haven't taken the top off my nasal decongestant spray since using your product. I was previously a chronic user." G.S.—SD.

When you use your COLLECTOR, you'll quickly feel the difference it makes and smell the freshness in your air. You'll actually see the elimination of smoke and dust in your air!

## SILICON VALLEY TECHNOLOGY

The COLLECTOR, incorporating years of high reliability design experience, is built with quality parts in the heart of Silicon Valley, USA, to give you years of trouble free service.

The COLLECTOR operates anywhere in your home or office for pennies a month and has nothing to wear-out or replace.

## SUPERPOWER OUTPUT

The COLLECTOR by Zestron is the only bipolar collecting ionizer with superpower output. The thoroughness and speed of air cleaning increases with more ion output, and Zestron ionizers give you the highest output (without detectable ozone). Check the comparison chart below. Don't buy any ionizer not stating output using the industry standard of ions/cc/sec. at one meter.

IONIZER	ADVERTISED OUTPUT (1 m.) ions/cc/sec.	COLLECTOR
The COLLECTOR	1,200,000	YES
by Zestron		
JSA Bubble	not stated	YES
Aspen	not stated	YES
Orbit	not stated	YES
AirCarell	236,000	YES
Ion Fountain	540,000	NO
Ion Cloud	350,000	NO
Ionosphere	350,000	NO
Modulian	75,000	NO
Ion Breeze	not stated	NO

## FREE ION DETECTOR

A FREE remote ion detector comes with each ZESTRON to verify and compare output. When you place the detector next to a ZESTRON and a competitive unit, you will see greatly reduced or no output from the competitive unit!

## SATISFACTION GUARANTEED

Order a COLLECTOR now and try it in your home or office risk free for 30 days. If for any reason you are not satisfied, return the unit for a full refund including return postage. The COLLECTOR has a full one year warranty on both parts and labor excluding abuse.

## ADDITIONAL DEALERSHIPS AVAILABLE

Reorders are pouring in, customers write: "We are enjoying the results of the first one and are ordering two more" Dr. J.B., M.C.—CA; "I'm a distributor for three other ion companies, and have to say I am extremely, extremely impressed." T.N.—CA.

ZESTRON, the leader in ion technology, has created a unique DEALERSHIP PROGRAM. Call or write for details on this RISK FREE OPPORTUNITY.

## TO ORDER—CALL TOLL FREE 800-372-1200.

In Calif, 800-372-1200 or (408) 371-1200. Use your credit card or send check or money order to Zestron, Inc., Dept. PM5, 667 McGlincey Lane, Campbell, CA 95008. Add \$4.00 shipping and handling per unit. (Calif. residents add 6.5% tax.) Orders outside U.S. add 15% to unit cost. Order two at \$109.95 each. For additional quantity discounts, call Zestron, Inc.



This talking phone TELLS you in clear English what numbers you're dialing.

# We'll Try to Describe Everything This Space-Age Phone Does In One Page of Small Type. It Won't Be Easy.



*The Everything Phone is a handsome, contemporary every phone with a standard modular plug, ready to go.*

It's as though someone said—  
"Let's think of *everything* any telephone can do, and combine them into one fantastic instrument."

Someone did say that. This is it.  
We call it THE EVERYTHING PHONE because it does everything. It advances the science of phone communications by ten years, even in this age of wild changes and improvements.

For example—

#### **This Phone Actually TALKS To You**

The Everything Phone speaks to you in a warm, gentle voice. It never tells you wrong. Touch the "Voice" switch and when you push a button, the phone tells you the number you've pushed. If you're working in dim light, you won't dial a wrong number, because your friendly phone voice repeats each digit immediately, as you dial it.

#### **A Complete Phone Answering System**

If you press the "Prefix" key, the "Clear" key, the Direct Memory Keys, or any of the other special function keys (more about these later), your Phone Voice tells you what you've pushed. If you get tired of company, you can shut off the voice; but it's like having a friend right inside your phone.

This feature takes some explaining.

In the bank of keys to the right of the dial pad are three marked M1, M2, and M3. M1 and M2 will tell a caller, when you're out, either when to call back or another number where you can be reached.

What about M3?

M3 makes any cassette recorder an answering device. Using the connector (supplied), your recorder can take messages up to the total length of any tape cassette. The Everything Phone turns the recorder on and off automatically when a call comes in.

So—you have your voice of 1) a message, in the phone's own voice, to call back at whatever hour you designate; 2) a message that you're out and can be reached at whatever number you designate; 3) an invitation to leave a message after the tone, with a capacity as long as the cassette—an hour or more.

#### **Memory Keys Galore for Automatic Dialing**

At the left of the numeric keypad are ten Direct Memory Keys. The key at the upper left is for MCI, Sprint, or other computer-code dialings. It holds the access number and your personal code number.

The other nine let you dial stored numbers, including long distance numbers, by pressing one key. You can inset a tab showing whose number is stored.

But you ain't see nothin' yet!

You actually can store up to 50 numbers of 20 digits each, using a two-number code. Example: If you already have 30 numbers in memory and you want to store 1-305-473-2044, punch in that number, use the "Store" key and "31", and you'll be able to dial that number in the future just by pressing "31".

#### **Quality Speaker-Phone**

Of Course The Everything Phone has one-way speaker-phone capability. Of course it's high quality sound.

Just press the "Speaker" button and you have a hands-free phone. A volume control gives you just the right amount of amplification.

#### **Music on Hold; "Mute" Switch**

You can put a caller on hold just by pressing the "Hold" key. What a pleasant surprise! Instead of dead sound, the person on hold hears a pleasant melody. (You'll hear it too, so you won't forget he's on hold.)

You have a "Mute" privacy button, and it couldn't be more convenient—it's right in the center of the modern hand-phone. Press that button, and although the other party won't be able to hear you, you'll still be able to hear him or her. Release the button and communications are normal again. (No tell-tale "click" when you press the Mute button.)

**Here's a List of Other Built-in Benefits**  
Your Everything Phone is an electronic butler. It has—

— Automatic redial. Press this key and your phone will redial the last number you called either once (if the phone is off the cradle) or four times (if the phone is in the cradle).

*Each key has a separate function. Each one talks to you, if you want it to. What a conversation piece The Everything Phone is!*

— Pulse/Tone selector switch. In areas with rotary dialing only, slide the switch to "P". In areas with touch-tone, slide it to "T".

— Ringer off switch. You can turn off the pleasant "chirper" (it isn't a bell) when you don't want to be disturbed. A separate ringer l.e.d. light will alert you, if you're interested.

— Access pause key. For Sprint, MCI, and other code numbers, the Pause button gives you the proper gap between the original dialing and the time the system takes to answer with a tone. The Pause has other uses, too, but we just can't list all of them here.

— Secretarial aids. Open a little door and you have a memo pad to jot notes. For the numbers stored in automatic dialing memory, slide out the Directory Card, concealed under the phone unit.

— Battery backup. Two tiny, easily replaceable batteries keep your memory intact. A power failure, even one that lasts for months, won't wipe out what's stored in the memory.

#### **Anything Else?**

Probably. We ourselves haven't figured out all the phone assistance The Everything Phone can give you. But we do know this:

*No other phone ever made has all the benefits and comforts this one has for you.*

**CAN YOU BELIEVE IT?  
THE EVERYTHING PHONE  
IS YOURS FOR JUST**

**\$199.95**

**two for only \$189.95**  
(+ \$4.50 shipping each)

Order your EVERYTHING PHONE  
by lifting your old-fashioned phone  
and calling toll-free:

**1-800-824-7888**

Ask for Operator 551.

(In California: 1-800-852-7777)

Have your VISA or MasterCard handy.  
Phones are manned seven days a week,  
24 hours a day.

#### **We Absolutely Guarantee!**

The Everything Phone is a lot of fun, and it's the darnedest electronic instrument you ever owned. But if at any time during the first full month you own it you decide not to keep it, send it back and we'll refund every cent you paid.

Send check or money order, or charge card information (\$199.95 + \$4.50 shipping—  
Total, \$204.45) to New Horizons, or call the toll-free number above.

The Everything Phone  
is another electronic marvel from  
**NEW HORIZONS**  
Dept. PM5, 1 Penn Plaza, Suite 100  
New York, N.Y. 10119



## (Continued from page 66)

A California brake and front-end mechanic said, "Ford really does an

A Texas store manager puts it this way: "I've owned Datsun pickups and wanted to buy another one, but my family gave me a lot of static about owning foreign cars. They asked me to look at the Ranger, which I did, and I really liked it. I'm most impressed with

Well, not totally. Sorry to burst the bubble, but in fairness, the Ranger's 2.0-liter engine comes from Ford of Brazil, and the four- and five-speed

(Please turn to page 70)

<b>Total miles driven</b> .....	2,045,167	<b>Specific likes:</b>	Good .....	44.0	<b>Average</b> .....	22.3
<b>Average miles per gallon:</b>		Economy .....	Average .....	10.7	Poor .....	12.2
Four-speed manual .....		Styling .....	Poor .....	1.7		
In town .....	22.3	Handling .....			<b>Number of vehicles owned:</b>	
On the highway .....	26.9	Comfort and ride .....	<b>Comfort opinion:</b>		This car only .....	21.5%
Three-speed automatic .....		Size .....	Excellent .....	47.6%	Two cars .....	54.5
In town .....	18.6		Good .....	44.2	Three cars .....	18.9
On the highway .....	22.7	<b>Specific dislikes:</b>	Average .....	7.7	Four or more cars .....	4.2
		No complaints .....	Poor .....	0.4		
<b>Engine choices:</b>		Disappointing mileage ..			<b>Makes of other cars owned:</b>	
Old 2.0-liter Four .....	31.5%	Needs more horsepower ..	<b>Had any mechanical trouble?</b>		Ford .....	44.8%
Old 2.3-liter Four .....	68.5	Rattles and noises .....	No .....	57.9%	Chevrolet .....	14.8
		Price .....	Yes .....	42.1	Oldsmobile .....	13.7
					Plymouth .....	7.1
<b>Transmission choices:</b>		<b>What changes would you like?</b>	<b>What type of trouble?</b>		Mercury .....	6.6
Manual four-speed .....	76.3%	More horsepower .....	Carburetor .....	27.6%	Buick .....	6.6
Automatic three-speed ..	21.9	No changes .....	Engine knock .....	13.3		
Manual five-speed .....	1.8	Better fuel mileage .....	Uses oil .....	10.2	<b>Age distribution of owners:</b>	
		Normal horn button .....	Electrical .....	8.2	15-29 years .....	24.5%
<b>Drive train choices:</b>		Smoother shifter .....	Engine diesels .....	7.1	30-49 years .....	44.3
4x2 .....	99.0%				50-plus .....	31.1
4x4 .....	1.0	<b>How much did you pay?</b>	<b>Dealer repairs satisfactory?</b>			
		Average .....	Yes .....	56.7%	<b>Would you buy another Ford?</b>	
<b>Why did you choose the Ranger?</b>		Range .....	No .....	43.3	Yes .....	88.8%
Economy .....	39.7%				No .....	11.4
Size .....	31.2	<b>Workmanship opinion:</b>	<b>Dealer service opinion:</b>			
Styling .....	20.5	Excellent .....	Excellent .....	26.4%	<b>Would you buy another Ranger?</b>	
Made in U.S. .....	15.6		Good .....	39.1	Yes .....	82.4%
Price .....	8.9				No .....	17.6

\*Percentages might not equal 100% due to rounding or insufficient data

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**"No matter what shape your pool's in, clean it automatically with Polaris Vac-Sweep."**

*Grace Dawson, San Diego*



If your pool is being cleaned once a week, Mother Nature gets it dirty every day. It's time you discovered

America's #1 automatic pool cleaner. Polaris Vac-Sweep. Your pool will be cleaner, faster, seven days a week.

**A cleaner pool, in just three hours or less.**

Send for the independent test report which proved Polaris cleans three times better than the popular sweep-type cleaner, in both concrete and vinyl liner pools. In only half the time. You'll see a big difference in energy savings, too.

**The only automatic cleaner that vacuums and sweeps the bottom and sides of your pool.**

Polaris utilizes two special reusable vacuum bags —



**Polaris**  
V A C - S W E E P

Happy pool owners have made us #1.

one for leaves & rocks — one for sand — to suit your pool's dirt conditions, even without a bottom drain. You wouldn't clean a house by only sweeping, why compromise on your pool? **Cleaner, faster, automatically, even under a solar blanket.**

A pool cover or solar blanket keeps energy in, but it doesn't keep dirt out. The Polaris Vac-Sweep may remain under cover for occasional cleaning to eliminate permanent staining. Truly automatic cleaning also means you'll spend less time taking care of your pool.

**Trade in your old cleaner and make a clean \$50.**

If you're tired of your old-fashioned, booster pump sweep cleaner, you can trade it in on a new Polaris Vac-Sweep. You'll get \$50 cash direct from the factory. See your Polaris dealer for the

brochure with specific details.

Polaris Vac-Sweep. It does a whale of a job in any shape pool.

Automatically.

## OWNERS REPORT: RANGER

*(Continued from page 69)*

manual transmissions are supplied by Ford's Japanese partner, Toyo Kogyo (Mazda). The pickup is, of course, assembled in the United States, and so are most components.

The Ranger enjoys a high workmanship score, with 87.6 percent of owners rating it good to excellent.

Two areas where the Ranger ran into flak were in engine power and fuel mileage. Our survey showed 17.3 percent of our owners were disappointed with their mpg figures, and 8.4 percent told us the truck needed more horses.

"The 2.3-liter engine with automatic needs more hill-climbing power and takes too long to get up to speed," wrote a California engineer. "Not only that, but I'm barely averaging 20 mpg combined city/highway. Of course, my Ranger has just about every accessory, and it's the long-wheelbase job. I should have waited for the V6." The V6 became available in mid-1983 along with the Ranger-based Bronco II.

A Georgia computer analyst adds, "Gas mileage isn't even close to the advertised 21/30 EPA mpg figures."

One constant aggravation—and this has applied to other Ford products as well—is the location of the horn switch.



*Placing horn switch at the end of turn-signal stalk brought some complaints.*

It's on the end of the turn-signal stalk. You push the stalk in, toward the column. This means you have to use your left hand to sound the horn and, as 7.5 percent of our respondents reminded us, that's a dangerous and, for many, an unexpected place for the horn.

Despite those few complaints, most Ranger owners expressed great satisfaction. A Colorado accountant said, "My 2.0 with four-speed has plenty of pep on the road and negotiates our mountains along with the best."

A New York shipping clerk added, "Good traction in mud and snow, and the Ranger has more power and load capacity than I expected from the small four-cylinder engine."

And a Florida educator commented, "I can't remember when I've been so happy with a new vehicle. I think Ford has a real winner."

**PM**

Take this ad to your local contractor or store for more information. Or, mail coupon today to Polaris Vac-Sweep, P.O. Box 1149, San Marcos, CA 92069 for a free copy of the independent laboratory test report, a copy of Nancy P. Brunning's "Swimming for Fitness," and \$50 trade-up information.

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## Be Adventurous!

Build PM's exciting new  
diving scooter  
SCUBA TOW SEL



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Whether you like adventurous scuba diving or just lazy snorkeling, this self-propelled water tow will make the going easier and more fun for the whole family. Using a single, tiny fishing motor, it whisks you along at about 3 mph for hours of leisurely sea adventure. You can use the scooter with or without scuba gear — an air tank adds to the fun and excitement, but it is not a must. You can also cruise along the surface, with just a mask and snorkel, watching the magical world of marine life passing by below you.

Complete plans for building PM's electric-powered diving scooter, including full-size cutting patterns and an illustrated instruction manual are \$10.75. Send your check or money order to **Popular Mechanics Dept. SEL, Box 1014, Radio City Station, New York, NY 10101.** Allow three to four weeks for delivery by third-class mail. If you prefer faster, first-class mail add 75 cents.

For more on water sports and home and shop plans include \$1.00 for PM's **PLANS AND IDEAS CATALOG.**



# A Breath of Fresh Air

**America's first negative ion generator plus 3-way filtering system . Cleans air of harmful pollutants and irritating pollen in your car, RV, or boat.**



Have you ever walked deep in the forest and noticed how "soft" the air feels around you? Or how invigorated you feel when walking on a brisk breezy day. . . or right after a thunder storm, when you suddenly realize that it actually feels great to take a really deep breath? These pleasant experiences happen because of the abundant negative ions which are naturally present in the clean air.

It is the lack of negative ions that makes our air stale, and studies have shown that the lack of negative ions actually contributes to our feelings of irritability, restlessness, depression, and fatigue. Coupled with this, it is well documented that the air we breathe is so overlaid with soot, smoke and dust, that city dwellers (even non-smokers) are prone to lung problems. And now, to make matters even worse, we have catalytic converters in our vehicles emitting hydrocarbon and acidic particles in the exhaust, so microscopically fine (1 micron or less), that a charcoal filter alone cannot rid the air we breathe of them.

## A scientific breakthrough.

Recently, some ingenious scientists have created a marvelous device, which revitalizes the air we breathe . . . the negative ion generator. These ion generators recreate Mother Nature's own handiwork by emitting negative ions into our air, just as during a thunderstorm. Until now, these amazing ion generators have only been available for your home or office. But have you ever wished you had one while you have been in a car with a cigarette or cigar smoker, or behind a cloud of exhaust in a traffic jam, or just wanted a breath of fresh air? Of course there is always your air conditioner, but that only cools and re-circulates the same polluted air, over and over again.

We have found a wonderful unit, so compactly designed, that it actually replaces the overhead dome light in your car, RV or boat. Besides being a functional overhead light, it also provides you

with a negative ion generator, plus it filters the air in 3 important ways . . . and was made expressly for away-from-home travelers.

**Eliminates smoke, pollen, and dust, plus it emits mother nature's own air cleaner.**

Immediately after installing the IONAIRE, you will notice the difference.

You can actually see it working, devouring any smoke or exhaust into its 3-way filtering system. The air inside your vehicle will first be drawn into the pre-filtering system, which removes large visible pollutants. It then moves on through electrical dust precipitating electrodes, which remove smoke and dust particles down to 1/100th micron in size. Then the air flows on through the activated charcoal deodorizing filter that is honeycomb shaped to allow efficient air flow. Finally, the air reaches the negative ion generator. There tobacco smoke, pollen, pet or cooking odors, dust and exhausts are literally cleared away, and all that is left is fresh, clean air. Go ahead! Take a deep breath.

**So easy to install - So wonderful to use.**

The IONAIRE may be installed in your vehicle two ways. First, for those wanting total portability from vehicle to vehicle, we have included a cigarette lighter adaptor cord for instant use. Or, this compact (8.5x8.5x2.75 inch) unit can be installed in place of the dome light in your vehicle. It's so easy to install that a screwdriver and pliers are all the tools you will need. As a bonus, you will eliminate smoke haze on your windows and actually keep the inside of your vehicle cleaner. Its many convenient features include a 2-speed Hi/Low air control volume switch and an alarm

light that automatically informs you when the filters are dirty and need to be cleaned. It also includes a warning alarm system with a 5 second buzzer to remind you that you have left the IONAIRE on after turning off the ignition.



**12 volt air purifier for your vehicle.**

The IONAIRE is so compact and quiet that you'll hardly be aware it's working. However, you will notice and appreciate the fact that the air you are surrounded in is fresh and clean, and you'll arrive at your destination in a healthier frame of mind. You will want to put one in all of your vehicles!

Order your IONAIRE today, and when it comes, go ahead and try it. If you are not delighted with the freshness and purity of the filtered and ionized air, and the high quality of the unit, send it back within 30 days for a full refund. One year warranty.

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# Make A Reel For Your Mower Cord

**T**his reel is designed to gather and store an electric lawn mower's power cord. Simply drive the reel's spike into the ground, hook the plug end of the cord to the reel and crank the handle to retrieve the cord. The reel can hold 100 ft. of 2-16 cable.

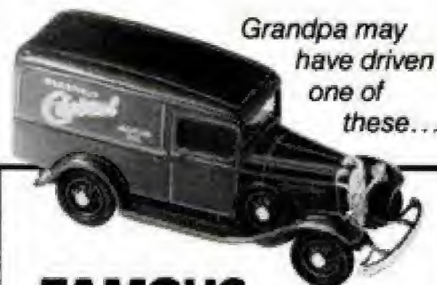
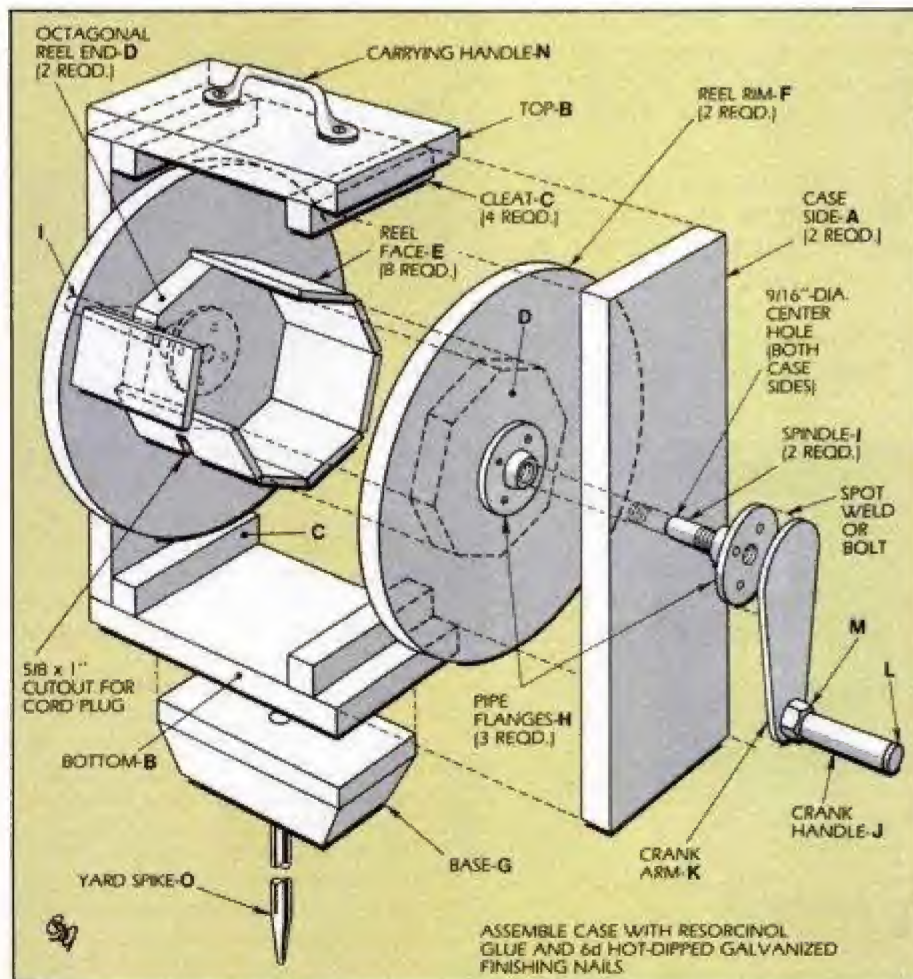
Start by cutting all the pieces. Notice that one reel face has a cutout for the cord plug. Before assembling the reel, centerbore a  $\frac{3}{16}$ -in.-dia. hole in each side piece to hold the spindles. Center-mount pipe flanges to the outside of the  $\frac{1}{2}$ -in.  $\times$  12-in.-dia. reel rims. The octagonal reel ends are then centered on the inside of the reel rims. The spindles are  $\frac{1}{4}$ -in.-dia.  $\times$  2-in. pipe nipples installed through the sides and threaded into the flanges. Assemble the unit with resorcinol glue and 6d hot-dipped, galvanized finishing nails.

Thread another pipe flange onto one of the protruding spindles for mounting the handle. The crank arm, cut from  $\frac{1}{8}$ -in.-thick strap iron, is welded or bolted to the outside flange. The crank handle is a carriage bolt in a pipe nipple (with its threaded ends cut off) mounted to the crank arm. Prior to handle assembly,

file the carriage bolt's square shaft section round to fit into the nipple sheath. There are two ways to mount the handle: 1. Weld a  $\frac{3}{16}$ -in. hexnut to the crank arm and screw the handle into the nut (as shown). 2. Bore a  $\frac{3}{16}$ -in.-dia. hole through the crank arm and thread the handle into a nut behind the arm. Complete the project with two coats of wood preservative.—*Walter N. Fritts*

## MATERIALS LIST—CORD REEL

Key	No.	Size and description (use)
A	2	$\frac{3}{4} \times 4\frac{1}{2} \times 15$ pine (case side)
B	2	$\frac{3}{4} \times 4\frac{1}{2} \times 7\frac{3}{4}$ pine (top/bottom)
C	4	$\frac{3}{4} \times 1 \times 4\frac{1}{2}$ pine (cleat)
D	2	$\frac{3}{4} \times 6$ -dia. pine (octagonal reel end)
E	8	$\frac{1}{4} \times 2\frac{1}{4} \times 4$ plywood (reel face)
F	2	$\frac{1}{2} \times 12$ -dia. plywood (reel rim)
G	1	$3 \times 3 \times 6$ pine (base)
H	3	$\frac{1}{4}$ -dia. pipe flange
I	2	$\frac{1}{4}$ -dia. $\times$ 2" pipe nipples (spindle)
J	1	$\frac{1}{4}$ -dia. $\times$ 3" pipe nipple (crank handle)
K	1	$\frac{1}{8} \times 1\frac{1}{4} \times 4\frac{1}{2}$ strap iron (crank arm)
L	1	$\frac{3}{16}$ -dia. $\times$ 2 $\frac{1}{2}$ carriage bolt
M	1	$\frac{3}{16}$ hexnut
N	1	Metal door handle
O	1	$\frac{3}{8}$ -dia. $\times$ 15" iron rod (yard spike)
Misc.		Resorcinol glue, 6d hot-dipped, galvanized finishing nails



Grandpa may have driven one of these...

## FAMOUS FORD TRUCKS

In 1933, Ford panel and pick-up trucks ruled the roads. And if grandpa drove one—for Castrol, Texaco, Mobiloil, or a host of other companies—it may well have been the original of one of the models pictured here.

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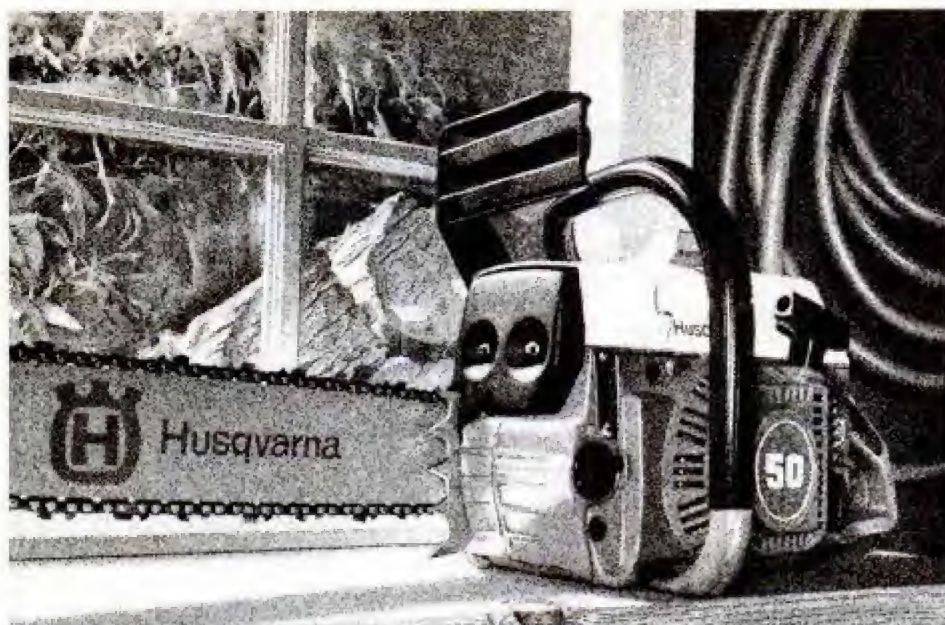
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## The Husqvarna 50 Rancher cuts weekends down to size.

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## HINTS FROM READERS

### Miterbox saver



A plastic miterbox, though inexpensive, is usually adequate for the average home workshopper. The big drawback is that the plastic base is weakened by the repetitive backsaw cuts. To save the box, install a 1/4-in.-thick piece of hardboard as shown. Replace this panel as required. —A. Weber

### Pipe prolongs fence life



You can postpone replacing fence posts that have rotted below the ground but are still solid above. Drive a length of pipe into the ground alongside the post and secure it to the post with pipe brackets (clamps).

Galvanized pipe is recommended for the longest lasting repair. But even galvanized pipe will crumble in two to three years in soil that is high in acid content. However, by using scrap pipe this is still a cost-effective technique.

In cold climates drive the pipe below the frost line to prevent it from lifting or heaving due to freezing. Paint pipe to minimize chance of ugly rust stains.

—David W. Roberts



# HINTS FROM READERS

## Hooks lengthen glue life



I have often found it difficult to reopen a tube of glue because the cap had become glued to the tube. I solved this problem by replacing the caps with standard cup hooks. Now, when I want to reuse a tube, I simply turn out the hook without any fuss or messy spills and the tight-fitting hooks help keep the glue fresh longer. The hooks also provide a convenient way to hang the tubes near my workbench.

—Howard E. Moody

## Protective cover

I use large pieces of old carpeting as a protective cover on sections of my workbench. The padding protects my woodworking and plastic laminate projects from scratches and marks. The carpeting also prevents small items and tools from rolling off the workbench.—Lane Olinghouse

## Ladder balance



To make it easier to carry a long ladder, determine its exact center and mark it with a stripe of brightly colored paint. Now you can immediately grasp the ladder at its midpoint and move it comfortably without the usual maneuvering for correct position.—A. Weber

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MPM7-0583



# PM LOOKS AT...

## Workshop Support Table

If you're already into woodworking—or soon plan to be—you're probably well aware of the need for workpiece support when working with various stationary shop tools. Because I, like most home workshopers, generally work alone in my shop, I frequently find myself having to handle a 4×8-ft. sheet of plywood singlehandedly. The alternative is very often to lay large pieces of 2×3s straddling a pair of sawhorses and use portable power tools. But, rather than lose the advantage of stationary tool accuracy, workshopers frequently rig a support table to serve as a helper.

Now, you can buy a support table that will always be available for those difficult tasks. The table shown sells for

*Legs adjust in height so rollers support work coming off any shop station or tool.*

*At right, a large piece of plywood is cut safely and effortlessly because table bears its weight as it leaves the saw.*

a reasonable \$149.95. With built-in rollers and legs that can be adjusted from 27½ to 48 in., it provides a table that can be used for all kinds of workshop tasks. Besides the obvious—supporting work as it leaves the table saw

or jointer, for example—I get added mileage from mine with a lightweight tabletop that I built to cover the rollers. It's made of ¾" pine and I have used it as an assembly bench—with the legs set at their lowest height to spare my back the high lifting a workbench requires. But I have also adjusted it up to 38 in. to use it as a workbench.

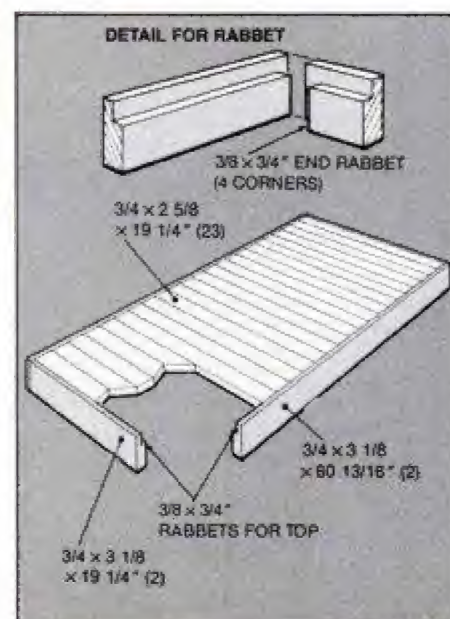
All in all, Supportable is a well-made product that deserves your attention. Bonus: Fold it up and hang it on a wall when you're done.—H.W.

### SPECIFICATIONS—TABLE

No. of rollers: 10; length: 16 in.; diameter: 2½ in.  
Table weight: 30 lbs.; length: 58½ in.; width: 17¾ in.; folded depth: 6 in.; adjustable height: 27½ to 48 in.  
Price: \$149.95 plus shipping (varies from \$4.63 to \$15.25, depending upon zone)  
Manufacturer: Turning Point, West Highway 16, Denmark, N.D. 58021



*Legs are adjusted one at a time (above, left); knob locks each extender in place. Above, with legs set to suit planer height, support table bears workpiece weight. At left is homemade tabletop (see drawing at right) that author created to get even more use from support table. It's of ¾-in. pine.*





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# Marlboro

A close-up, profile view of a man with a mustache wearing a cowboy hat and a yellow shirt. He is holding a pack of Marlboro cigarettes in his left hand and a lit cigarette in his right hand. The background is a blurred landscape with a blue sky and green hills.

© Philip Morris Inc. 1993

Warning: The Surgeon General Has Determined  
That Cigarette Smoking Is Dangerous to Your Health.

16 mg. "tar," 1.0 mg. nicotine av. per cigarette, FTC Report Dec '81





# RESCUE BY A SATELLITE!

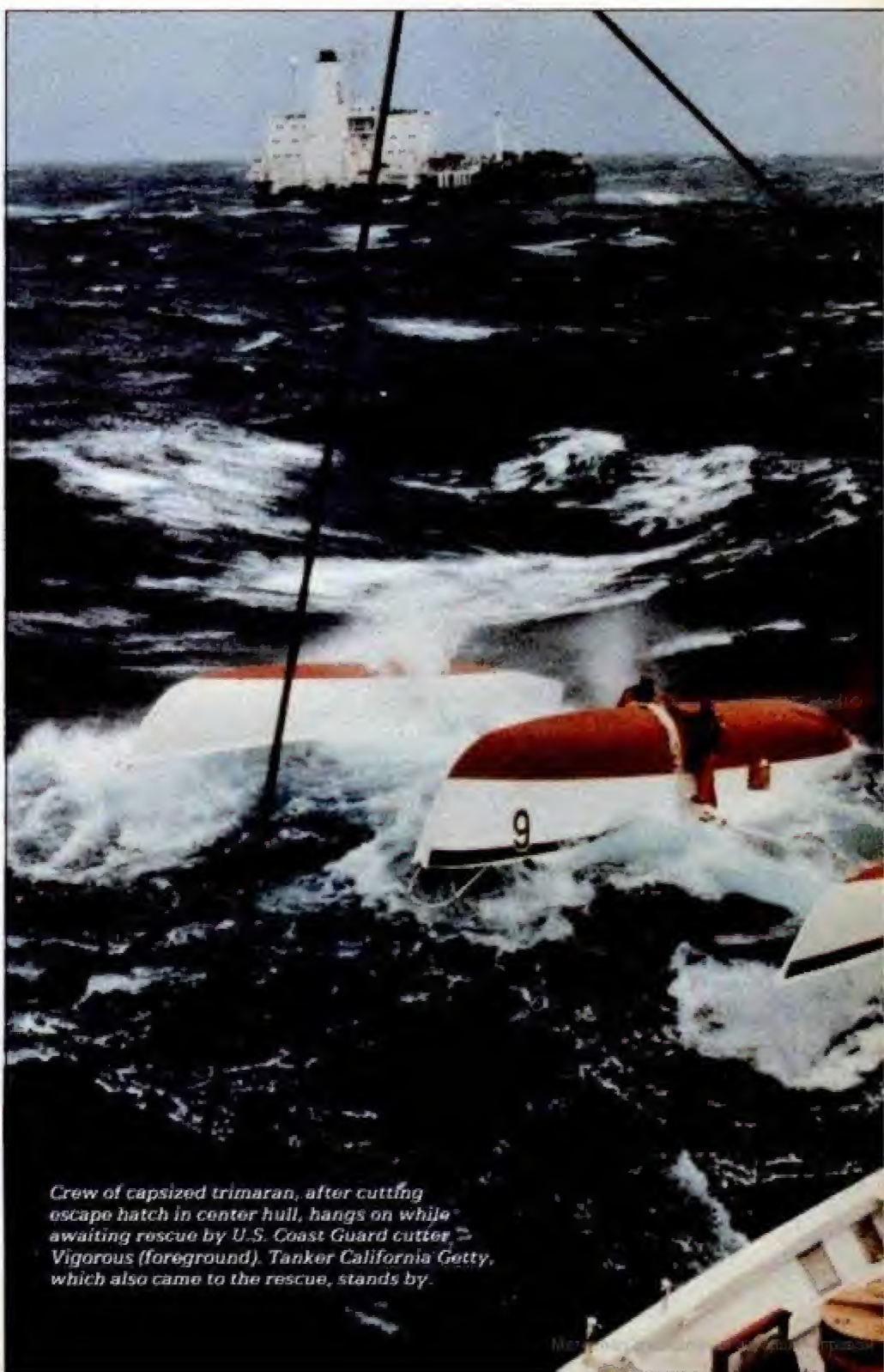
Crossing the Atlantic, the trimaran *Gonzo* capsized. But a Soviet satellite was listening for the cry of any troubled ships.

BY JACK SOMER

**W**hen Walter Greene and his two crewmen set out on a dangerous Atlantic voyage by trimaran, they were ready for almost anything. But they never dreamed their lives would depend on the power of a Russian satellite.

At about 0830, Sunday, Oct. 10, 1982, during a violent North Atlantic storm, the 50-foot trimaran *Gonzo* capsized in 30-foot seas some 300 miles east southeast of Cape Cod. Walter Greene, 38, a renowned sailor and *Gonzo*'s designer/builder, was at the helm. When *Gonzo* flipped, Greene was thrown into the churning sea, under the massive but graceful hulls. He swam underwater and, after several attempts, reached one of the outer hulls, or *amas* as they're called, and surfaced. It took less than a minute, as Greene recalls, by which time his crew, Robert Goodman, 28, and Aneirin Williams, 22, who had been asleep inside the main hull, regained their balance.

The three companions were sailing from Portland, Me., to Dartmouth, England, then delivering *Gonzo* to St. Malo, France, where Greene was to start the quadrennial *Route du Rhum*, a 4,000-mile race to Guadeloupe for solo sailors. The storm had risen unexpectedly; ocean weather forecasts from the



Crew of capsized trimaran, after cutting escape hatch in center hull, hangs on while awaiting rescue by U.S. Coast Guard cutter *Vigorous* (foreground). Tanker *California Getty*, which also came to the rescue, stands by.

PM photo: Dale Holmes  
PM art (overleaf): Ed Valligursky





TO SCOTT AFB

COSPAS

CANADIAN SEARCH  
PLANE

FROM  
SCOTT AFB

CUTTER  
VIGOROUS

EPIRB

9

Signal from Gonzo's Emergency Position Indicating Radio Beacon was picked up by COSPAS satellite, which relayed position to Scott Air Force Base in Illinois. A Canadian rescue plane also received the position. Scott AFB radioed Coast Guard, and cutter Vigorous responded. Coast Guard broadcast also was picked up by California Getty, first ship on the scene.





Coast Guard at Portsmouth, Va., and weather warnings from WWV, the Bureau of Standards time-tick station in Colorado, indicated no worse than 30-knot winds. But by Saturday evening, three days out, *Gonzo* was plunging into heavy seas and battling winds gusting to 50 knots.

Before dark, Greene elected to strip *Gonzo* of all sail, alter course to run before the easterly gale, and tow warps and sail bags to slow the boat and stabilize her steering. Still, she was unmanageable and nearly broached 10 times during the night. And during Greene's morning watch she surfed off a large wave at high speed and her starboard hull dug deep into the trough. The inertia instantly flipped her on her back. Unlike ballasted monohulls, which can right themselves when capsized, an upside down trimaran,

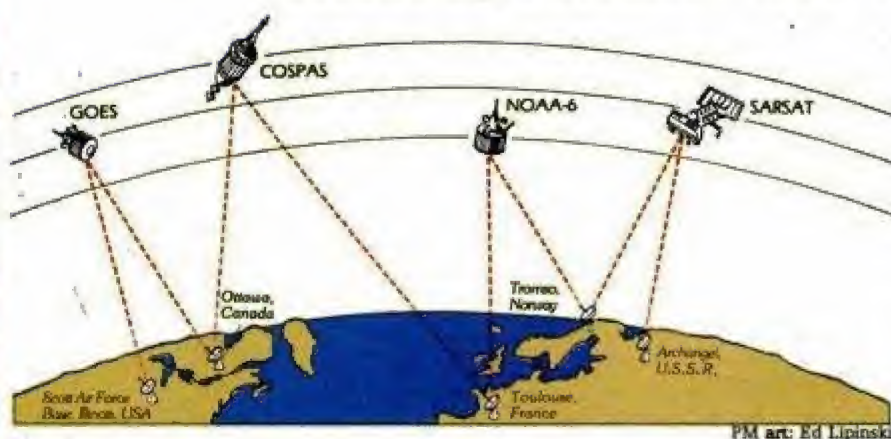
though it floats, is a helpless creature at the mercy of wind and wave.

Fortunately, Greene and his crew were not helpless creatures. Williams had, in fact, survived an earlier trimaran capsize, and Greene had sailed trimarans more than 40,000 miles. In less than half an hour the three donned survival suits to avoid hypothermia. Then Greene was passed a keyhole saw with which he cut away the wood around a porthole to make a hatch. Williams found and activated the yacht's EPIRB (Emergency Position Indicating Radio Beacon). Thus began one of the most remarkable rescues in marine history—the first ever in which a satellite played an instrumental role.

The EPIRB is a small radio that transmits a distress signal over 121.5 and 243.0 MHz (commercial and military

*(Please turn to page 188)*

## Rescue By Satellite—How It Works



distress signal into an actual location when picked up by one of the rescue satellites is done through Doppler-effect shifting of the radio frequency. As the satellite nears the beacon, the signal is received at a slightly higher frequency than it was actually transmitted; as the satellite flies away, the signal sounds as if it were at a slightly lower frequency than it really is. In its rescue of *Gonzo*, COSPAS provided five separate possible locations within less than 50 miles of one another based on signals received on different passes.

The satellites circle the earth in a relatively low orbit about every hour and a half, at speeds of 300 miles per minute. If a satellite's orbit were properly designed, a single vehicle could provide worldwide coverage—although any one location would be serviced for only several brief periods during each day. COSPAS did that job admirably. Now, since there is coverage from more than one satellite, the same area is monitored several dozen times a day.

Computers aboard satellites in the system record, store and play back to ground stations every two hours. But more advanced signal systems scheduled to be deployed during the next five years will decode telemetry signals which specify the type of vehicle, the craft's registration and ownership, and even the time and nature of the accident.

The system has worked in the most out-of-the-way places. When the yacht *Blue Jeans* lost engine power during a South Atlantic storm last year, her crew of seven waited for calm winds, then hoisted her sail and made for what appeared to be an anchored tanker in the little traveled spot. But the tanker turned out to be a long-abandoned and grounded vessel. At that time, COSPAS picked up the *Blue Jeans'* EPIRB beacon, and all aboard her were rescued within three days.

—James Oberg

**W**ithin a 30-day period late last year—after the rescue of the *Gonzo* crew—two downed planes and a yacht whose engines had died in a storm were located with "guidance from above." Twelve lives were saved. The agency was not supernatural, but man-made—a satellite rescue system.

A worldwide system, part of which is shown above, will, when complete, be made up of specialized satellites which pick up distress signals and transmit positions to ground bases. The first of these heavenly rescuers—Russia's COSPAS, launched early last year—did all the rescuing during 1982. But the French ARGOS transponder, which is aboard the GOES satellite, helped searchers find some troubled ships by giving generalized positions, placing them within 300 miles of an SOS. America's newly launched SARSAT (Search and Rescue Satellite, Aided Tracking) will be on line this year. SARSAT carries a Canadian-built transponder and French-built computer electronics and weighs only 65 pounds. It also serves as a weather satellite. The total cost to the United States has been estimated at \$29 million, with an approximately equal cost

split by Canada and France. Another U.S. satellite, NOAA-6, also will go up this year.

Ground stations are being installed in Alaska and California to cover most of North America. One is already in operation at Scott Air Force Base in Illinois. A Canadian station is located in Ottawa. The Soviets have a station in Archangel, while European stations are being set up in Toulouse, France, and Tromsø, Norway.

The satellites in the system are designed to pick up distress signals from beacons which automatically transmit an SOS if subjected to great shock (such as in an airplane crash). They also pick up signals from handheld transmitters called Emergency Position Indicating Radio Beacons (EPIRB).

The distress beacons are battery powered and generally transmit with a power of less than one watt so they will be effective for at least 48 hours. Rescue aircraft can also pick up the distress signals, but must be within 200 miles to detect the signal. Sometimes, when the beacon is snuggled amid rough terrain, it can be heard only from directly overhead.

The conversion of the received radio dis-



# COMPLETE GUIDE TO VIDEO CAMERAS

They plug into any videotape deck and allow you to be your own movie director.

BY DAWN GORDON

**I**f you're using your videotape recorder (VTR) just to watch movies on your TV set, you're missing the fun of being your own director and making your own video movies. With a video camera, you can record your family parties, business conferences—anything you might use an old-style film camera for. And you can record hours of material for a few dollars and not have to wait for processing before you see the results.

These cameras connect to both home and portable videotape decks. If you're using a portable VTR, the camera can go right along with you (getting its power

from the VTR's power pack slung on your shoulder). Or, attach the camera to a nonportable unit and record indoor events.

Always comparison shop when you're ready to add a camera to your video setup. We'll help you choose one with the features you need and at a price that makes sense. Our chart at the end of the story gives an all-inclusive comparison of cameras to consider.

## The viewfinder

The most important feature is the viewfinder, and there are three types available: optical, through-the-lens and electronic. The optical variety is similar to a

*(Please turn to page 184)*

*The wide-eyed world of video can be shaped to everyone's viewpoint with these new, easy-to-use cameras. Our model looks through the finder of the Hitachi VK-C2000, one of the first cameras to feature MOS technology (see text). The other cameras shown are representative of the many available, some of which include features such as auto-zoom, variable-speed zoom, auto-fade, auto-focus and character generators. The chart that follows tells which features go with what cameras and gives information on prices and specifications.*



PM photos: Bill Ashe



**SHARP QC-70**



**GENERAL ELECTRIC 3035**



**SANYO VSC-450**



**HITACHI VK-C2000**





# GREAT AMERICAN ACHIEVEMENTS

**S**tretching high across violent eddies of New York's East River, the Brooklyn Bridge—100 years old this month—stands as a monument to America's great age of invention. With every new stone and each new cable, the bridge broke ground in the field of civil engineering and managed to be called the "Eighth Wonder of the World"—even at a time when the electric light and the telephone were invented.

Much more than a monument, the bridge is sweet vindication for the visionary designer who died before the first caisson was sunk, and his son, who carried on with the 13-year building project, braving the bends, several political corruption investigations and charges from other engineers that his bridge wouldn't last 10 years. Today, civil engineers are so sure the bridge can easily go another hundred years that New York has earmarked \$100 million to make minor repairs—a paint job, replacement of some suspender cables, minor road resurfacing and the like—over the next 15 years.

When John Roebling, a German immigrant who had turned from farming to surveying to wire rope making and bridge-building,

*Angled stays and vertical suspenders extend from towers and cables to the roadway, holding it taut.*



*Roebling's wire strands were joined along 100-foot sections with ferrule joints (right). Then 19 wire ropes, made up of 300 strands each, were wire-wrapped to form cables.*



PM photo: Arthur Sudofsky

Manhattan, New York, 1900. The Brooklyn Bridge is the longest suspension bridge in the world.



# The Brooklyn Bridge Turns 100

The crowning achievement of 19th-century civil engineering, the Brooklyn Bridge remains in good enough shape to stand tall into the 21st century.

BY DON SAYENGA



Each of the wire strands was looped around the carrier (above, left) and then pulled to the tower, where the rope for the bridge was formed. The wire strands are seen at their Brooklyn anchorage (above, right), where engineers inspected the building materials.





Inside the work chambers under the caisson, crews of 30 to 40 men broke up riverbed around cutting edges to allow caisson and bridge tower to settle down to the bedrock.

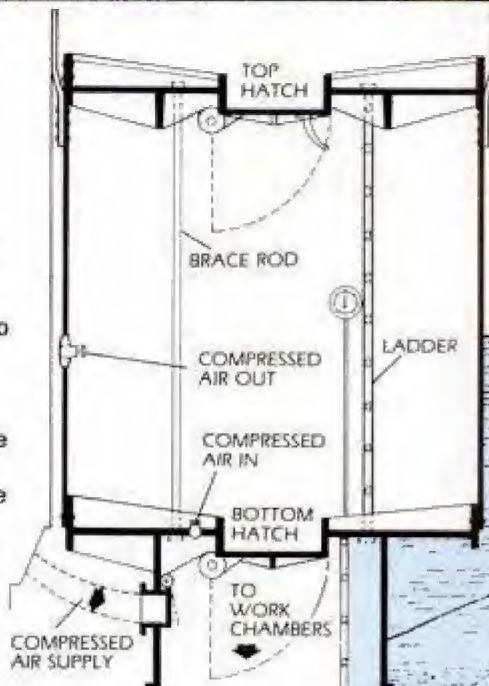
first conceived of the bridge, nothing that large had been tried in suspension bridges. Critics said it would take far too many tons of iron cable to hold up a roadway. To span 1,595 feet of river, while at the same time keeping the waterway clear for tall ships, the bridge roadway would have to be an impossible 119 feet high. It would need an approach road of more than a quarter mile on either side. It could never support the mass transit system envisioned by Roebling.

Newspapers charged the bridge idea was a "Grand Boondoggle," and the famed magazine *Scientific American* noted that a tunnel from Brooklyn to New York would do the same job at half the cost. But Roebling, who had built a smaller-scale suspension bridge in Cincinnati, promised prospective stockholders that the bridge would be "the greatest engineering work of the continent and of the age."

Under the auspices of a semiprivate corporation in which New York and Brooklyn were major shareholders but a small group of private citizens retained control, ground was broken for the Brooklyn tower in January 1870.

The elder Roebling, who slipped, fell and cut himself on the foot a week before construction was to begin, died of tetanus even before ground was broken.

His son, Col. Washington Roebling, a civil war hero, had worked almost constantly by his father's side and filled the great shoes so well that one day the younger Roebling would quip: "Long ago I ceased my endeavor to clear up the respective identities of myself and my father. Many people think I died in 1869."

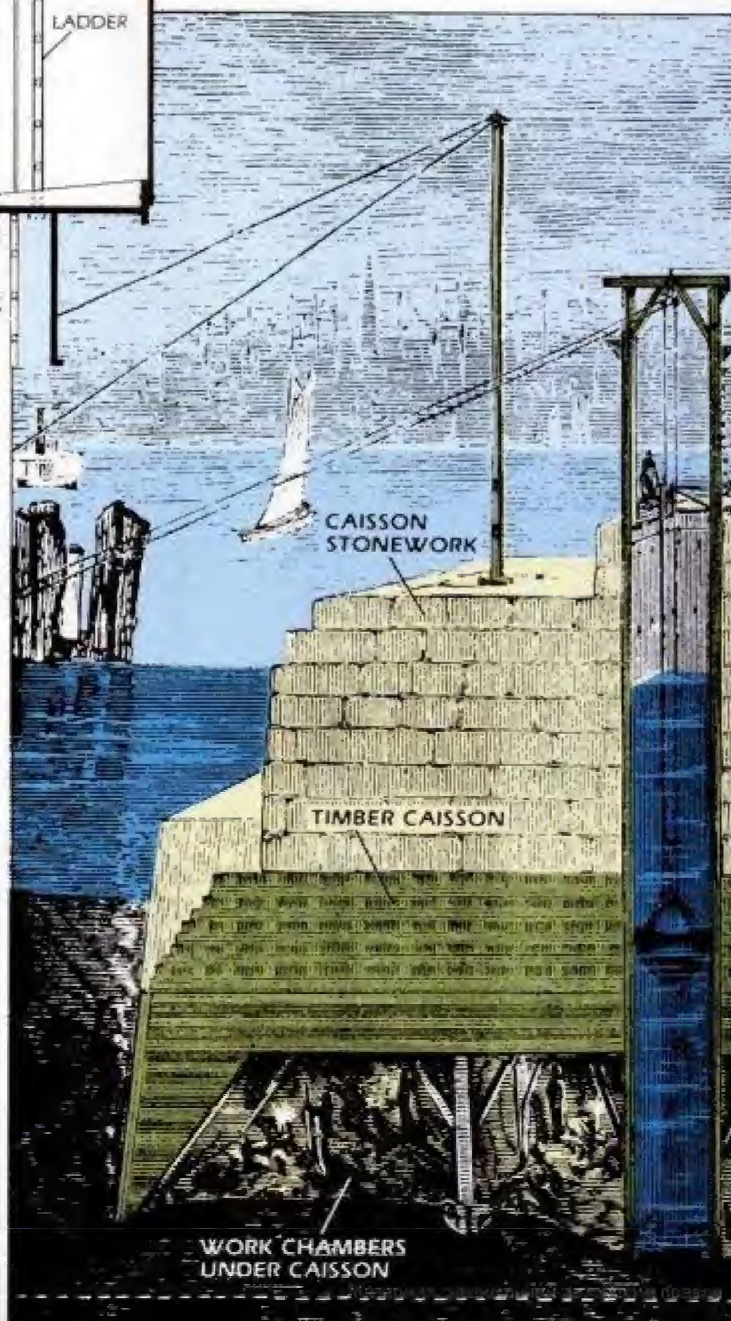


The 27,500-ton Brooklyn-side timber caisson with its stonework (right) would eventually bear the weight of the bridge tower. Men working under the caisson picked away at the riverbed to let the caisson cutting edges sink deeper. A clamshell scoop brought the diggings up to the surface through a water-filled tube designed to maintain air pressure in the work chambers. Men entered the caisson work chambers through an airlock, a cross-section of which is shown above. Workers entered through the top hatch, the airlock was pressurized and they went out the bottom hatch and down ladder.

Young Roebling's first challenge was to erect towers that would stand 276 feet above high water. First a caisson was built of extra-heavy, sap-rich pine on the Brooklyn side. (Critics said the caissons should be of iron, since pine would rot and suffer under the attack of river worms. But in a 1960 engineering study, it was noted that the wood was still heavy with sap and no worms had undermined it.)

The timber caisson had the shape of an enormous iron-clad 168 feet by 102 feet. Before the first stone was laid atop its roof, it weighed 3,000 tons. Launched like a ship slightly downriver from the bridge site, the caisson was pulled by tug. When her lines were cut, the huge wooden box bobbed up and down in the water for almost two months, as workers laid on extra courses of lumber and heavy stone imported from New Jersey and Connecticut.

The bridge caissons (another was





built on the Manhattan side) were giant cutting tools, with pointed edges, or skirts, that pressed into the riverbed as row upon row of stone was placed on top. They weighed 27,500 tons each. The caissons were also huge diving bells, with the cutting edges enclosing a hollow underneath that was divided into work chambers.

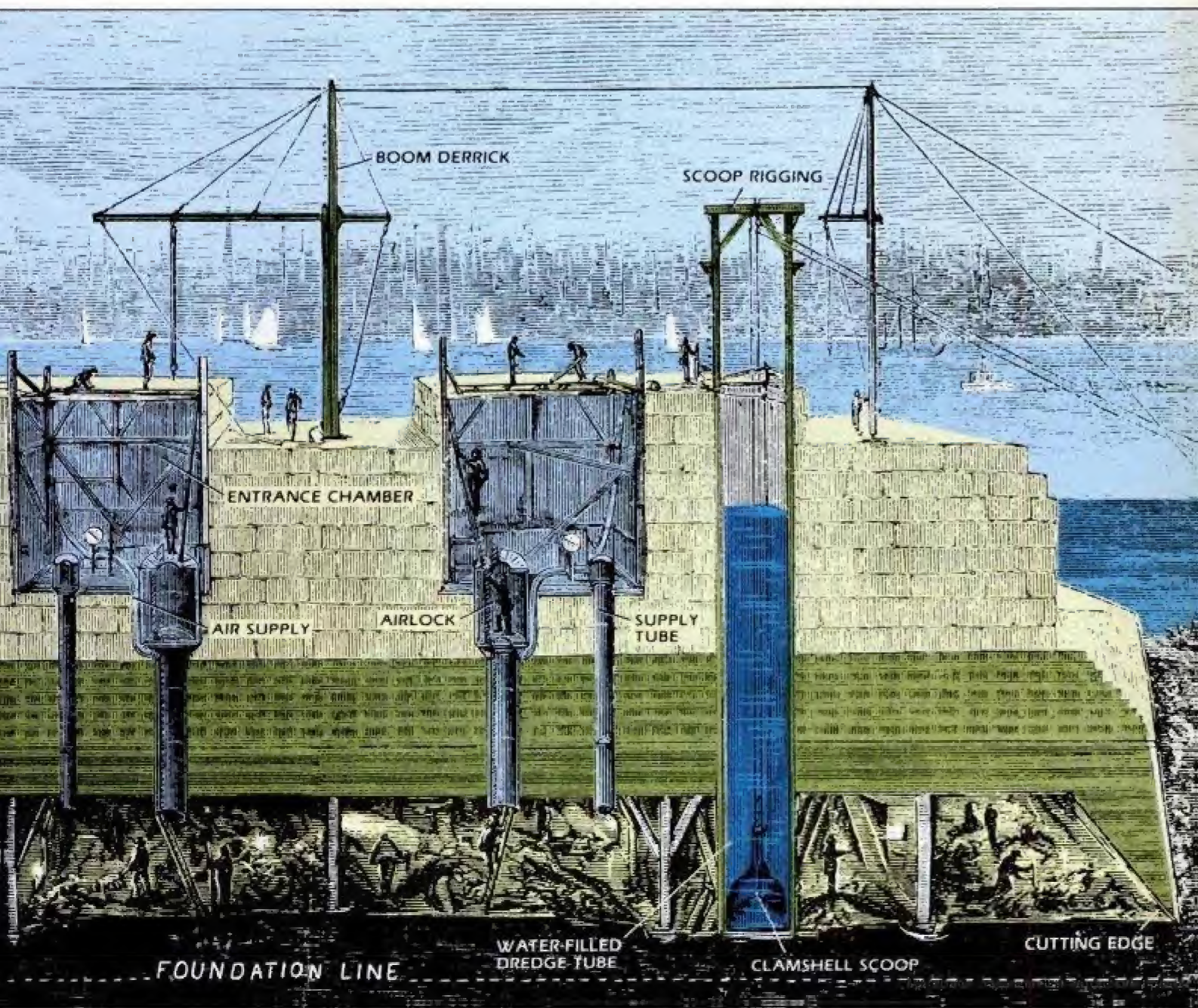
### Men dug beneath caissons

Going down into these chambers were various tubes. The dredge tube was filled with water to help keep the structure righted in deep water and against the pressure of the fast-flowing river. A thinner pipe carried compressed air into the work chambers at the caisson's bottom to overcome the increasing pressure as the box sunk toward bedrock. This allowed work crews of 30 to 40 men to work in each submerged caisson, digging away at the sand, rock and limestone beneath the river. The men went

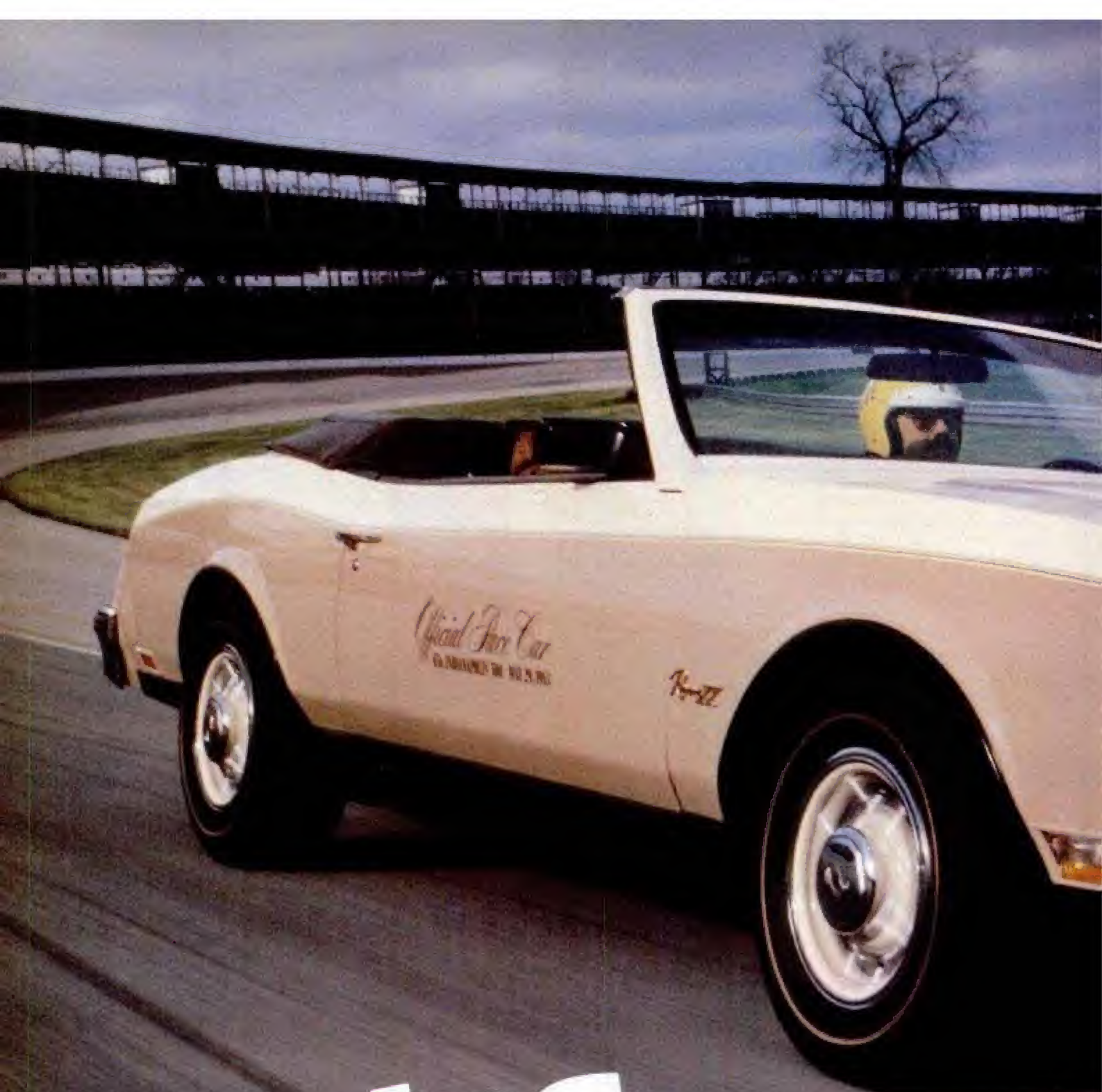
*(Please turn to page 193)*



The first mass transit system on a suspension bridge crossed the Brooklyn Bridge in 1883. Stationary steam engines pulled a wire cable that hauled trains along tracks.







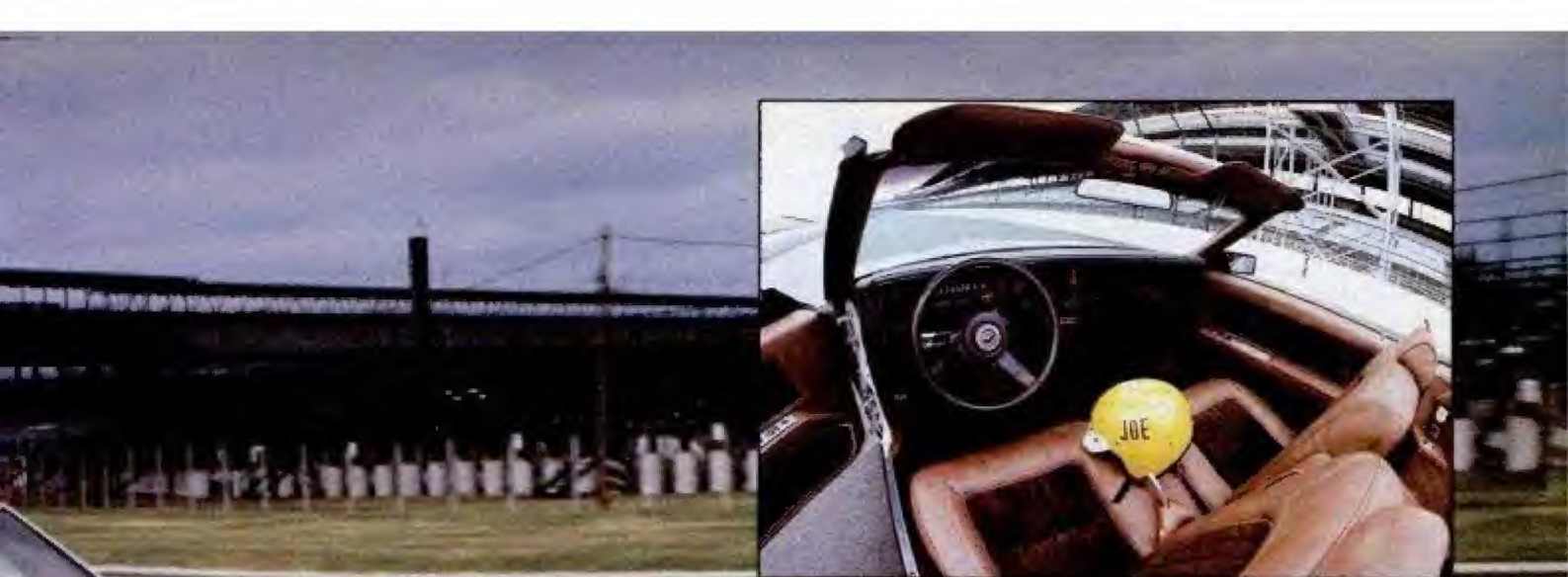
# Pacing The Pack

## DRIVING THE INDY 500 PACE CAR

You can't buy a twin-turbo 350-hp Buick Riviera convertible. But you can ride with us!

BY JOE OLDHAM  
EXECUTIVE EDITOR





*This will be Duke Nalon's office on May 29. Leather, suede and a \$900 steering wheel will help make his job more bearable.*

*PM photos: Ron McQueeney and Dan Francis*

**I**t's cold in Indianapolis in January. And at the Indianapolis Motor Speedway, it's even colder. The wind whips off turn four with the fury of 33 turbocharged, fuel-injected race cars ready to take the green flag.

But on this January morning, there are no race cars. There are no mechanics making last-minute valve-clearance adjustments, no crewmen taking final tire-pressure tests, no drivers donning their Nomex fireproof suits and no 400,000 fans screaming and cheering and singing "Back Home In Indiana."

In fact, on this bleak, overcast day, the Indianapolis Motor Speedway is deserted. The

stands are empty, the infield Snake Pit at turn one mute. Only the wind makes a sound, a shrill whistle, as it blasts down the front straight, past the thin strip of bricks that mark the starting line of the Greatest Spectacle in Sport.

Just a solitary car sits on the starting line today. It's a very special Riviera convertible that will pace the pack at the start of this Memorial Day's 67th running of the famous Indianapolis 500.

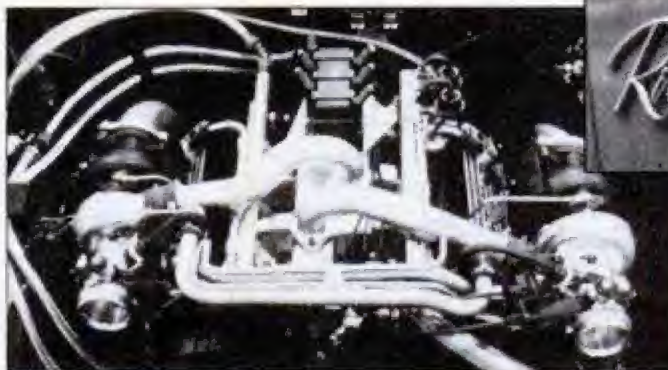
And we are going to drive it.

It's a bit weird to see a convertible sitting around with its top down in the middle of winter in Indianapolis. But that rather bizarre sight



is only the first of a series of shocks to our sensory mechanisms on this day, mostly wrought by the guys at Buick Engineering who, we would learn, have managed to transform a rather sedate but classy cruiser into a snarling, fuel-injected, twin-turbocharged, computer-controlled, 350-hp, brute-force machine that has enough power to peel back your eyelids, compress your spine into the seat, and produce so much wheelspin that you'll think you're fighting it out with Don Garlits for top eliminator.

In fact, one of the problems during the development of the Riviera XX has been *too much* power. That's the word from George Claypole, the genius engineer in charge of putting the Riviera's monster engine together. Thanks to an adjustable turbocharger boost dial, you can literally tell the computer how much power you want—up to about 500!—and the en-



*Riviera XX*

*The Riviera's engine is a symphony of polished alloy. The gold emblems signify that the pace car is a one-off special.*

gine will make it, no questions asked. For race day, though, Claypole tells us that he'll dial in somewhere around 350.

"That should be adequate to get the job done," he says nonchalantly.

With so much power on tap at the twist of a dial, we're a little apprehensive as we climb into the plush leather- and suede-trimmed interior and buckle up. The handmade real

wood steering wheel is said to have cost \$900 alone, but we haven't been able to get anyone at Buick to confirm or deny this little bit of extravagance. Dennis "Duke" Nalon, the legendary driver of the brutish Novi race cars in the 1950s, who will actually drive this Riviera to pace the race on May 29, will be very pampered indeed.

We turn the key to start the engine, expecting to be buffeted by the mon-

## A BRIEF HISTORY OF INDY PACE CARS

### 1911—STODDARD DAYTON



### 1925—RICKENBACKER

The first pace car, Stoddard Dayton (left), led 1911, '13 and '14 races. Driver was Carl G. Fisher, Speedway founder. Eddie Rickenbacker, aviator, carmaker, race driver, Speedway owner, drove his Vertical 8 (right) in '25.



### 1933—CHRYSLER

The big Chrysler LeBaron roadster (right) was driven by Byron Foy as it paced the 1933 Indy race. The car had special chrome spoke wheels, hopped-up engine, and other special equipment.





ster under the hood. Instead, the engine starts quickly with a single twist of the key and immediately settles into a very smooth 700-rpm idle. The only clue we have that there are 350 horses under the hood comes from the subdued but authoritative burble from the custom-fabricated exhaust system.

We drop the shift selector into DRIVE, our left foot still on the brake. Can an engine this smooth and quiet really pack 350 hp? We decide to find out.

Mashing our right foot flat to the floor, we simultaneously release the brake pedal with our left. In an instant, the front tires of this front-wheel-drive Riviera are spinning and smoking and howling. We let off. Too much throttle. Flooring it won't do with this baby. We stop, startled by the incredible power output of this 252-cu.-in., six-cylinder engine.

Try again. This time, let off the brake and bang on about three-quarters throttle. Again, the front tires are clawing at the pavement and sending off clouds of white smoke. Still too much. Hold the brake. Hit the throttle about halfway down. That's it. The big Riv is moving out now with just a slight touch of wheelspin. A perfect start. We're rolling about 50 feet now so let's punch it open.

Mash the throttle to the floor. The Riviera hunches down on its suspension and moves out now. There's no sensation of the turbochargers kicking in, no nothing, except a strong, insistent urge at the small of our back. It presses us back into the seat and keeps us there as long as we keep our foot down. After several seconds, we're traveling at an incredible rate of speed. Our peripheral vision shortens as things alongside the track whiz by in a blur. Still, we're pressed back

into the seat, the icy cold wind blasting past our face, numbing it, our helmet forced back against the headrest.

Let off a little and the pressure against our back eases. The speedometer is well past the peg off the end of the dial. Now we're more aware of what we're doing. We're past turn one and halfway into turn two. The VIP suites that hang from the top of the Speedway in turn two are silhouetted against the gray sky as we turn slightly left and dive down into turn two and onto the long back straight.

At 200 mph, Indy drivers will tell you that the back straight is bumpy. But here, now, at about 110 mph, it's just one long stretch of smooth concrete, the slight imperfections in the roadway soaked up with nary a whimper by suspension engineer Ray Smith's chassis modifications.

As turn three looms closer, we set up  
(Please turn to page 192)

changing position. The pace car maintains control until the green comes on again.

Although there have been several snafus involving pace cars, only one was serious. In 1971, Indianapolis Dodge dealer Eldon Palmer was driving the Dodge Challenger pace car when he overshot the braking marker on the start lap, lost control and crashed into the photographer's stand, seriously injuring several people. Since then, all pace car drivers have been required to have racing and/or high-speed driving experience, which is a good rule since almost all recent pace cars have been virtually race cars themselves.—J.O.



#### 1954—DODGE

Dodge was first firm to build replicas of pace car for sale to the public, producing 701 Royal 500s in '54. Real pace car (left) had dual-quad Hemi engine, special trim.

#### 1969—CAMARO

Chevrolet cashed in big on the 1969 Indy pace car promotion (right) when it built about 3,450 Rally Sport Pace Car replicas, which went on sale through dealers.



#### 1948—CHEVROLET

Indy 500 winner Wilbur Shaw paced race in '48 Chevy convertible (left), then the next year in '49 Olds convertible.



The pace car that marked the beginning of a cult was the '78 Corvette special edition (right). Chevrolet built 6,500 replicas and the car became an instant collector's item.



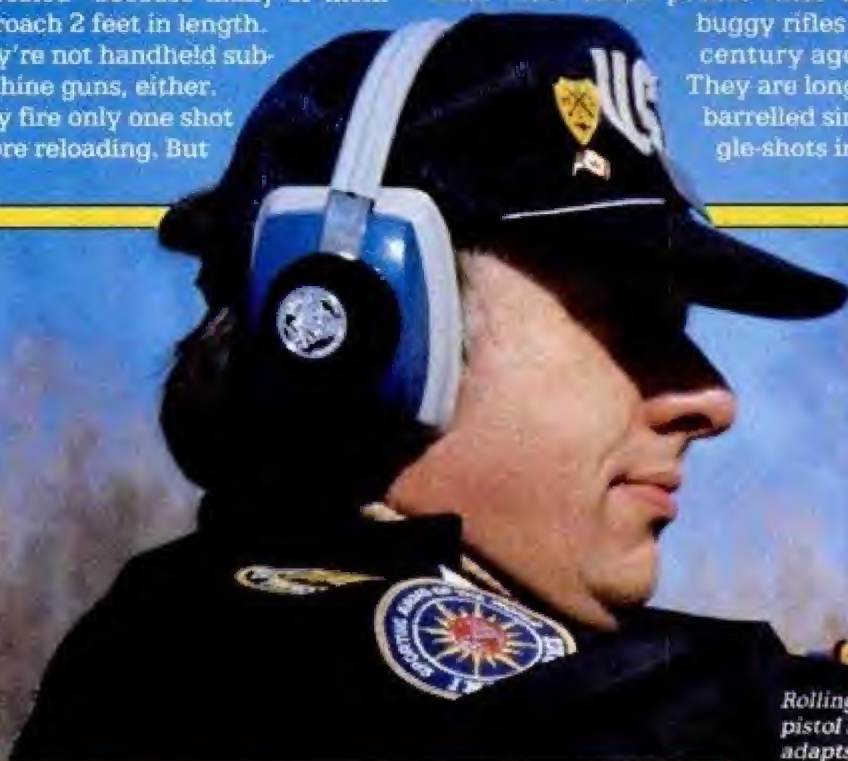
**A** new breed of high-technology handguns for superspecialized shooting has appeared in the land over the past few years. They're not supersmall or readily concealed—because many of them approach 2 feet in length. They're not handheld sub-machine guns, either. They fire only one shot before reloading. But

they can do things that few fast-firers can attempt. In fact, there is some question about whether they're really handguns at all.

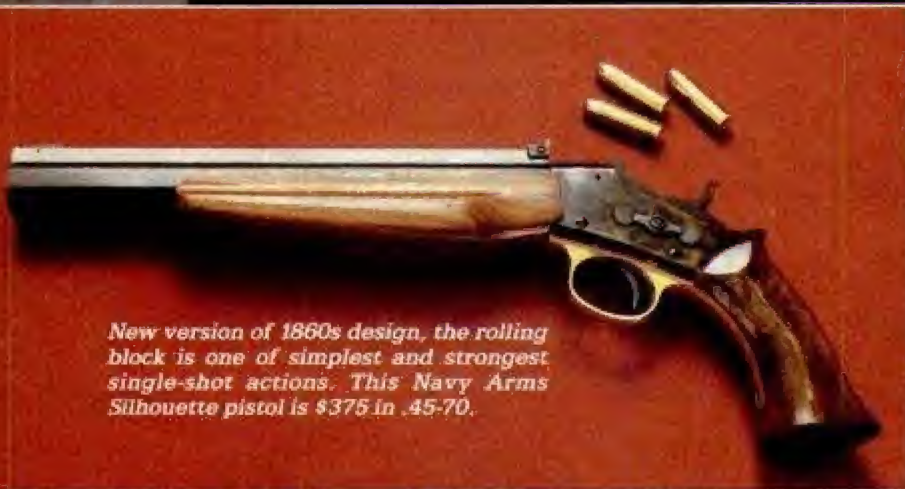
These are the latest generation of what were called pocket rifles or buggy rifles a century ago. They are long-barrelled single-shots in-

tended for super accuracy and high power at ranges once thought impossible for a one-hand gun. Just like their muzzleloading ancestors, they are far more closely related to accurate target and hunting rifles than they are to what most of us think of as handguns—semi-automatic pistols and revolvers.

Like rifles, many of them shoot cartridges that were once thought



*Rolling Block Silhouette pistol by Navy Arms adapts an old design to the latest high-power, high-tech, long-range handgunning sports. Roy Ricketts tries for a 200-meter ram with a .45-70 405-grain bullet.*



*New version of 1860s design, the rolling block is one of simplest and strongest single-shot actions. This Navy Arms Silhouette pistol is \$375 in .45-70.*

PM photos: Frank Lusk, J.D. Jones  
Guns for photography: Navy Arms,  
Leslie Edelman Inc.

*SSK converted this Remington XP-100 from .221 Jet to buffalo stompers like .358 Winchester, .45-70 or even .50-70 rifle calibers. Holes near muzzle (inset) are recoil arrester which helps keep kick from breaking your wrist.*





of only as rifle cartridges. Calibers range from .22 Long Rifle rimfire up to and including .50-70 Government.

Everyone knows the ubiquitous .22, but the .50-70 has faded from the ken of most modern shooters. Collectors and black powder single-shot buffs recognize it as the first centerfire cartridge adopted by the U.S. Army for general issue in the

1866 Springfield Rifle. The .50—as gunwise shooters will recognize—is the caliber, nominally half an inch, but actually .512 plus or minus a few thousandths in the rifling grooves. The 70 refers to the powder charge—70 grains of black powder. The original bullet weighed 450 grains or a tad over an ounce of lead. It went out the muzzle at about 1,200 feet per second (f.p.s.).

This buffalo stomper probably killed larger numbers of the American Bison than the more famous Sharps. In a handgun, even a high-tech handgun weighing more than 5 pounds, it can be a real wrist-breaker if not handled right.

Most of the super single-shots, though, are chambered for either special, hand-loaded, wildcat car-

*(Please turn to page 202)*



# New Pistols That Shoot Like Rifles

Perfect for the sport of silhouette shooting, these pocket rifles get hits out to 300 yards.

BY ANGUS LAIDLAW



*Stock Remington XP-100 bolt-action, single-shot pistol in .221 Remington Jet was originally for varmint hunting, but now comes in 7-mm for silhouette shooting.*



*Thompson/Center Contender breaks like a shotgun. Barrels interchange for many calibers. A complete T/C Contender Super 14 (14-inch barrel) costs \$285.*



# New Look For Fishing Favorites

**T**he newest fishing boats don't have tri-hulls, squared-off bows, and flat bottoms banging across the waves. Seen from the side, a bass boat may look like a runabout and go fast enough to tow skiers or win a race. Notice a more pointed bow, higher sides and deeper-V hull for a smoother ride. Styling is slick and streamlined. Windshields have been added to deflect the wind at higher speeds and are raked aft.

The only tip-off from abeam may be a control console sticking up like a con-

High-tech has come to the lowly skiffs for anglers: They're faster and safer.

BY BILL MCKEOWN BOATING EDITOR

ning tower amidships. Adapted from the larger offshore skiffs, where a big gamefish may force an angler to fight it around the boat's perimeter, the center cluster of controls lets the helmsman stay where there is less bounce.

Look down from a bridge, however, as the latest angling craft below head offshore, and you'll see interior layouts that leave no doubt about what their skippers have in mind. Foredecks are trimmed to make room for bowriding and casting. Level flooring and casting platforms provide a base for stand-up action. There are assorted enclosed rod racks, tackle compartments, aer-

(Please turn to page 204)



The light aluminum hull of a johnboat, the pointed bow of a runabout and the pedestal seats of a bass boat are combined in the Lund Pro-Angler to provide sportsmen with a multipurpose fish-chaser.

MFG is back in the boat business with the Adventurer Sport-14 that is produced from matched metal dies. This results in a uniform fiberglass hull that has a slick inside-outside finish.







*For drift fishing (above) or powering on plane out to a favorite fishing hole, Fisher Marine's new SV 4 semi-vee bass hull is an aluminum, center-console model rated for 60-hp outboards. Generous freeboard keeps out spray, gives added safety.*



#### **New high-performance bass boat power**



*First look: Especially for the popular bass chasers, Johnson is introducing a GT V6 racing-type, 150-plus-hp motor. Evinrude will have similar XP-150-plus model.*

*Open bowrider foredeck of the Silverline Sport Scrambler (above, left) allows forward casting for fishermen, but the stylish speedster can be used to tow skiers, as well.*

*Styled like a runabout with raked windscreens and pointed bow, but mounting pedestal seats for fishermen, aluminum Fisher Sweet 16 Fishabout (left) is bass boat in disguise.*



# Today's Top Tuners

New, highly sophisticated tuners are making the case for separate components again, instead of tuner and amplifier together on one chassis.

BY CHRISTOPHER GREENLEAF

NAD 4150



*Carver TX-11 has impressive FM stereo signal tracking; special circuit delivers noise-free stereo even in fringe areas. NAD 4150 also tracks FM signals with great precision, using a new Schotz circuit.*

FM photo: Lou Jawitz

CARVER TX-11



**M**ost of us are in the "deep fringe" of FM for at least a couple of the stations we tune in. Here are new tuners that reach farther, give more noise-free stereo at greater distances and—wonder of wonders—are relatively simple to operate.

An FM signal doesn't always occupy the same amount of space or bandwidth, and its strength fluctuates from moment to moment, so a few new models actually track the signal according to its status at any given instant. Others lock in very solidly on a station, far more accurately than was possible before. Still others feature very legible, accurate meters that give precise information of signal strength, on-center alignment and multipath conditions. The end result is a good reproduction of the signal the broadcaster sent out initially. These tuners are so good that they can

even show up bad broadcasting!

Here, with prices ranging from a high of \$1,145 to an affordable \$280, are our five terrific tuners.

### Tandberg 3001

Tandberg has eliminated some of the last stumbling blocks in conventional analog tuning and given us a glimpse of future FM quality. Designed by the Norwegian firm's famous technical staff, the 3001 is nearly alone among analog (that is, nondigital) tuners in its ability to provide eight station presets and retain a conventional tuning dial. Using the memory button doesn't move the dial's pointer; rather, it shows the selected station's location on a separate meter which also functions as the tuner's signal-centering indicator. There's also a signal-strength meter with very accurate indexing from 3 microvolts all the way up to a whopping 3 volts.

The bandwidth the unit picks up can be switched between wide, normal and narrow, an unusual and welcome versatility.

FM stereo noise is tackled by gradually decreasing channel separation as the signal from the antenna worsens. This is an effective bit of circuitry that keeps the stereo as good as conditions up at the antenna will allow. Technical journals, in discussing the 3001, have stated that this tuner often exceeds the abilities of their equipment to measure its performance. Because Tandberg intended the 3001 for very critical ears, a number of radio stations use it to monitor their broadcast quality. It even has outputs for lab-quality equipment. There are also settings on the back for 25-, 50-, and 75-microsecond pre-emphasis, for European, Dolby B and standard U.S. broadcast sig-

*(Please turn to page 190)*

### ADCOM GFT-1A



*Adcom GFT-1A has eight memory presets along with particularly quiet tuning. Tandberg 3001 uses conventional, analog dial along with eight separate, pushbutton memory presets.*

### TANDBERG 3001





*This is the setup to use when you want to sharpen a chisel or plane iron. Adjust table at the desired bevel angle and use the sander (belt) to notch the back of a piece of wood so that the top edge will rest approximately 1/16 in. from belt. Clamp wood in place to serve as a support for the job. The platen is needed during this operation.*

## A Craftsman's Secrets For Using The Sander/Grinder

This little machine with its narrow abrasive belt is underrated by many, but you'll be amazed at all it does.

BY ROSARIO CAPOTOSTO PM photos by the author

**T**he narrow-belt sander/grinder is a versatile little machine that's big on performance. With it, you can sand, grind, sharpen, deburr, finish, contour and polish almost any material.

The sander/grinder is no newcomer. It has been used widely in industrial shops for many years. Recently, however, the tool has been turning up in many home workshops and it is quickly

becoming the craftsman's favorite tool.

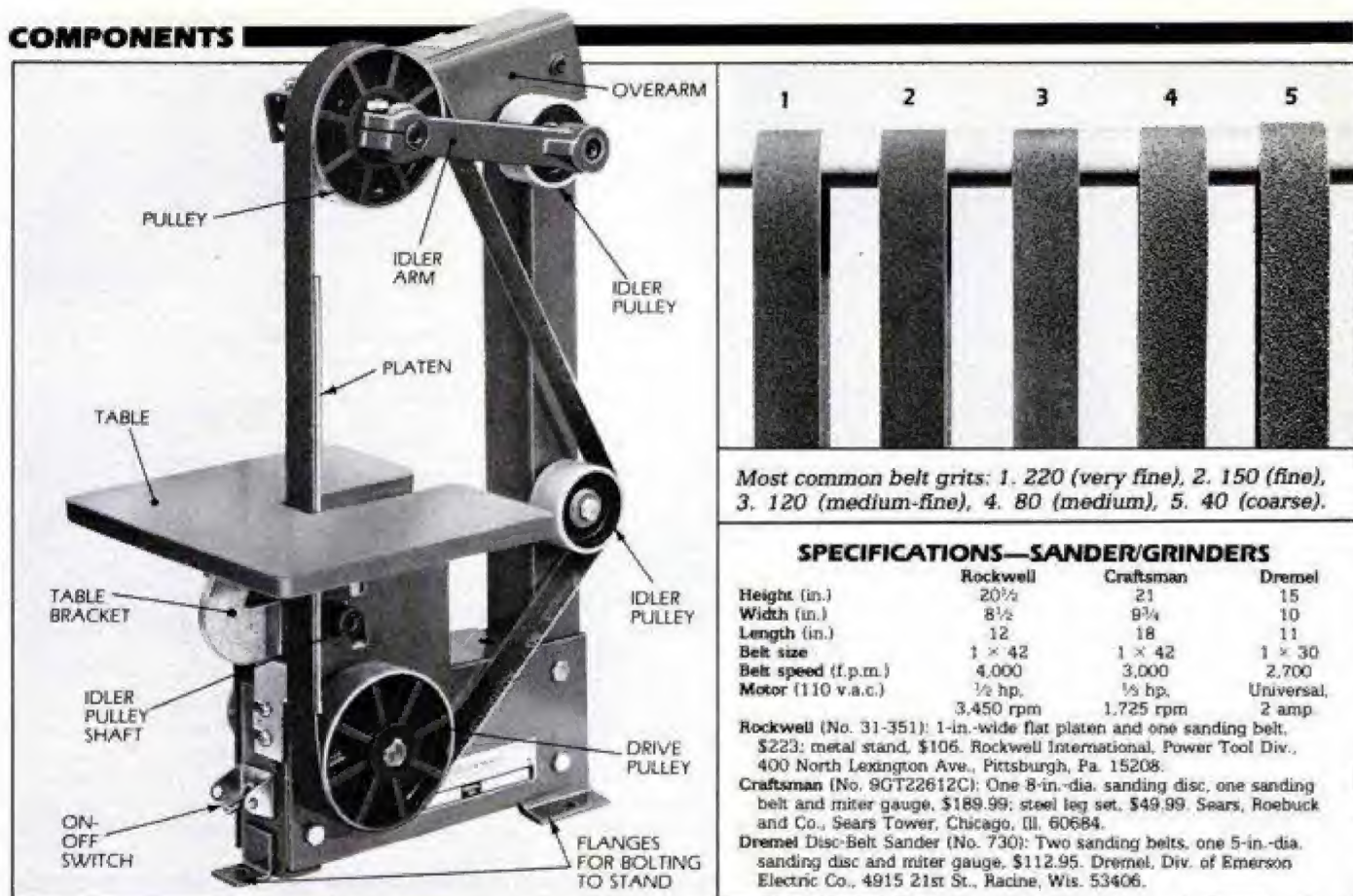
If you already own a sander/grinder, then you're aware of its capabilities. But some of the techniques and applications on the following pages may be new to you. If you're considering purchasing this unique machine, it will prove to be a valuable asset to your workshop because of its relatively low cost and its overall versatility.



*Narrow belt easily removes saw blade marks while smoothing outside curve.*



## COMPONENTS



Most common belt grits: 1. 220 (very fine), 2. 150 (fine), 3. 120 (medium-fine), 4. 80 (medium), 5. 40 (coarse).

## SPECIFICATIONS—SANDER/GRINDERS

	Rockwell	Craftsman	Dremel
Height (in.)	20½	21	15
Width (in.)	8½	9½	10
Length (in.)	12	18	11
Belt size	1 x 42	1 x 42	1 x 30
Belt speed (f.p.m.)	4,000	3,000	2,700
Motor (110 v.a.c.)	½ hp.	½ hp.	Universal
	3,450 rpm	1,725 rpm	2 amp

**Rockwell (No. 31-351):** 1-in.-wide flat platen and one sanding belt, \$223; metal stand, \$106. Rockwell International, Power Tool Div., 400 North Lexington Ave., Pittsburgh, Pa. 15208.

**Craftsman** (No. 9GT22612C): One 8-in.-dia. sanding disc, one sanding belt and miter gauge, \$189.99; steel leg set, \$49.99. Sears, Roebuck and Co., Sears Tower, Chicago, Ill. 60684.

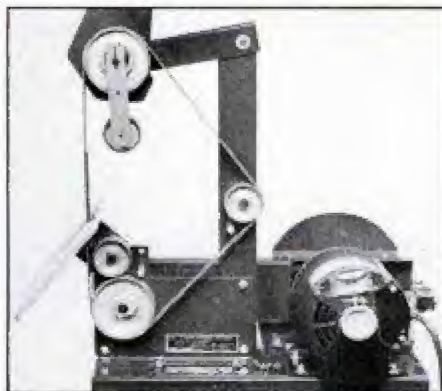
**Dremel Disc-Belt Sander** (No. 730): Two sanding belts, one 5-in.-dia. sanding disc and rutter gauge, \$112.95. Dremel, Div. of Emerson Electric Co., 4915 21st St., Racine, Wis. 53406.

Rockwell's sander/grinder with its parts identified. Chart (above, right) gives technical data for the three machines shown.

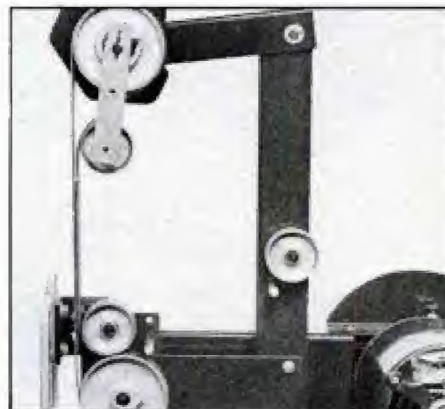
### THREE SANDER/GRINDERS



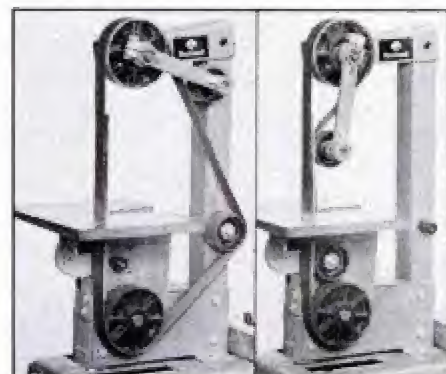
**Craftsman's machine can be bench-mounted, or installed on stand as shown.**



*Craftsman with guards removed to show belt threaded for external sanding. The tilting worktable allows bevel work.*



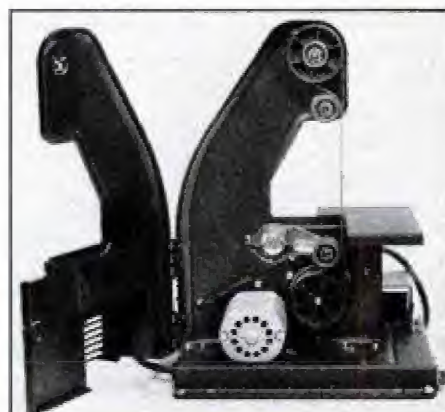
*Belt is threaded for internal sanding.  
Remove the platen for contour sanding.*



*The Rockwell model is shown with the belt threaded for external sanding (left) and internal sanding (right). Notice that the idler pulley shifts forward.*



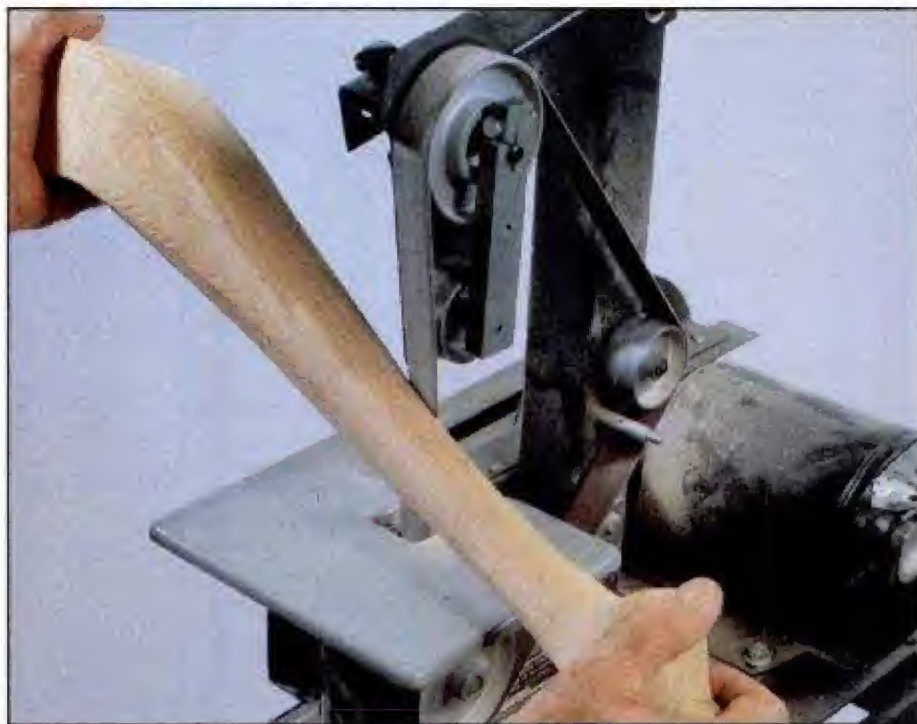
*The lighter duty, benchtop Dremel disc-belt sander is a more compact tool than the Rockwell and Craftsman models.*



*The Dremel, with the platen removed, is now ready for internal contour sanding.*



## USING THE SANDER/GRINDER



Time-saving contour sanding is used to shape this table leg. With the platen removed, the flexible belt easily follows the shape of the leg. Use light pressure and steady motion to avoid cuts (ridges) as you move the workpiece across the belt.



You can utilize the top pulley for shaping and for smoothing many inside curves.



Use a narrow strip of belt for sanding very small areas. Turn the belt inside out and slit it with a razor knife. Tear in one direction for a few inches, then in the other. Using this method will prevent the sanding belt from unraveling.

## ABOUT BELTS AND PLATENS



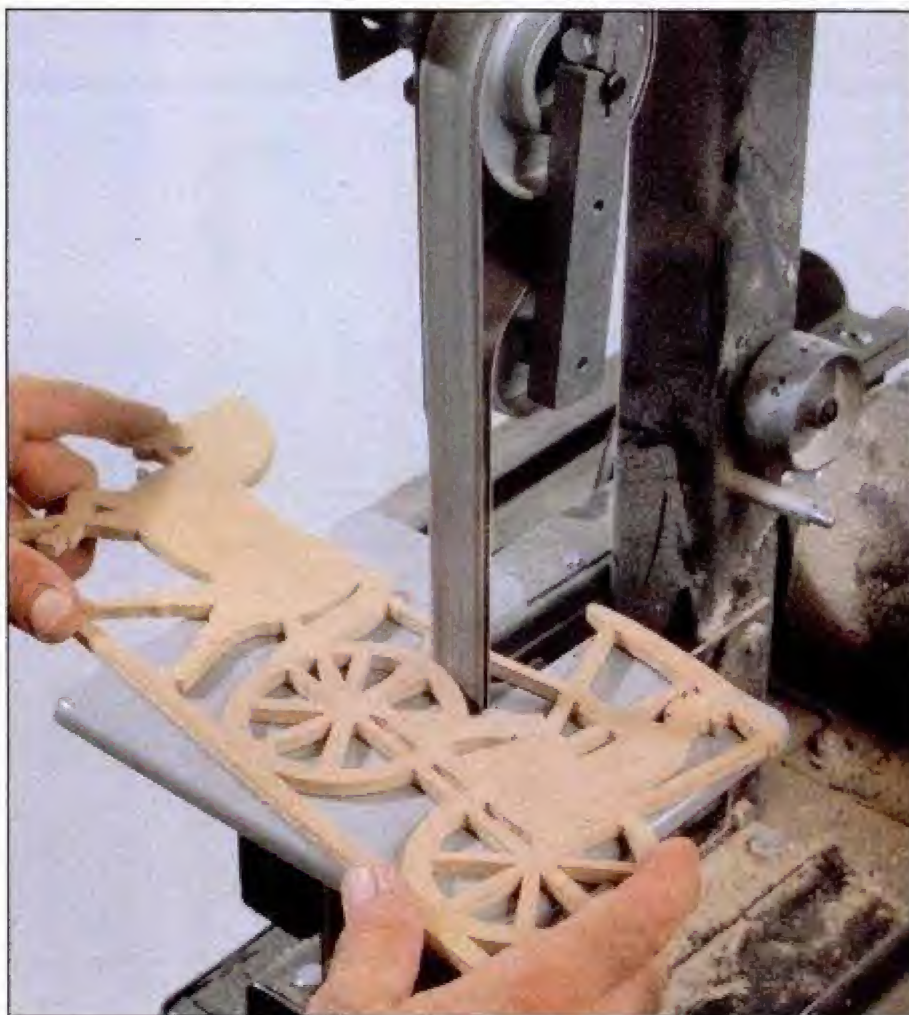
This convex platen is a Rockwell accessory for sanding inside curves. A curved wood block clamped to the other machines will serve the same purpose.



Thread the belt through the opening in the workpiece for internal sanding jobs.

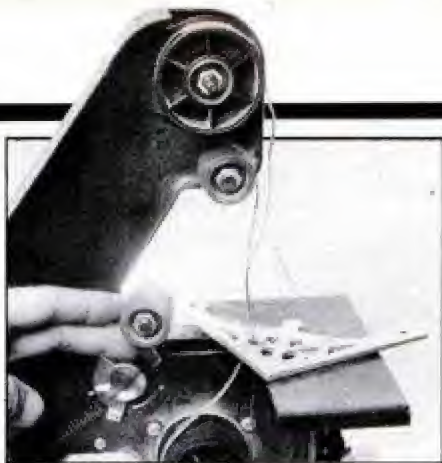


Use the belt's thin edge for sanding in tight crevices and sharp corners. Remove the platen during this operation for greater access to the sanding belt.



With the platen removed, the belt's flexibility is utilized for the internal sanding of circular shapes. The finer-grit belts are more flexible than the coarse belts.





Sanding small fretwork requires a narrow belt. Spring-tensioned idler arm is pushed forward to take up slack.



Apply a frosted finish to glassware by using an 80-grit (medium) belt and a felt chalk eraser as a back-up pad.



Use your finger to guide the belt into tight spots. Tape or adhesive bandage is wrapped around finger for protection.



For sanding the most intricate details, guide the narrow belt with a thin wood block. You can make custom-shaped blocks for sanding specific contours.



When grinding a nonferrous metal like aluminum, apply a low-melting-point grease to the belt to prevent clogging.

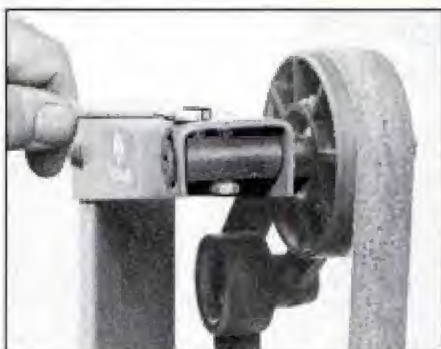


To polish metals, turn a worn belt inside out and apply a rouge compound (left). Light pressure produces a bright finish (right). Be sure belt is completely worn to prevent wear on the pulleys.

## TRACKING THE BELT



Two belt tracking adjustment knobs are used to control right and left belt movement on the Craftsman model.



Control the belt on the Rockwell model with these two bolts. Turn bolts in opposite directions to adjust belt.



The belt tracking adjustment on the Dremel unit is located within the housing.

As a sander, this machine takes over where large, broad-belt sanders (both portable and stationary) leave off. The narrower belt can accurately sand intricate workpieces quickly, thus saving the hours it would take to sand the piece by hand.

As a grinder, it outperforms a conventional stone grinder by cutting and sharpening faster while operating at cooler temperatures. This minimizes the danger of drawing the temper (allowing the metal to become too hot, thus weakening it) when sharpening tools or during metalworking.

Shown here in various operations are three sander/grinders: Sears Craftsman, Rockwell and Dremel (called the Dremel disc/belt sander). All three performed admirably.

The Craftsman and Rockwell are about equal in size and capacity. Both models utilize 1 × 42-in. abrasive belts and have tilting worktables for bevel sanding and grinding.

The smaller, lighter duty Dremel uses a 1 × 30-in. belt. The Dremel model is designed for bench top use.

Both the Rockwell and Craftsman machines can be bench mounted or installed on accessory stands. Rockwell's metal stand (No. 50-510) can be purchased with or without retractable casters (No. 50-118). Craftsman's steel leg set (No. 9 GT 22239C) is equipped with rubber-padded leveling feet. A floor stand allows the sander/grinder to be more accessible when working on long or irregularly shaped pieces. Unless you are limited by workshop floor

space, you'll find this to be a wise investment.

Aluminum oxide abrasive belts are available for all three makes, ranging from a coarse 40 grit to an extra-fine 320 grit. In addition to the conventional abrasive belts, Rockwell offers a brushing/cleaning belt (No. 31-476) for removing rust, deburring metal or polishing glass, and a nonabrasive wool belt (No. 31-477) for high polishing of metals and sheet plastics.

All three machines operate using a 1-in.-wide flat platen (a rigid, metal plate used to back up the belt). Rockwell also offers a ½-in.-wide flat platen (No. 31-364) and a ½-in.-radius convex platen (No. 31-365).

Another Rockwell accessory is a 1 ×  
(Please turn to page 194)



**O**ur oak sideboard (often referred to as a server) came into being simply because my wife has maintained that one of the biggest needs in a dining room is an attractive place to store infrequently used items such as bowls, vases and large serving platters.

Since her preference was for a dark Victorian piece topped by marble, I opted for oak for this project, and I mixed stains to create exactly the hue desired. The stain mix is spelled out in the finishing section.

The server was inspired by a number of similar pieces observed and studied at antique shows, auctions and the like. Most of the originals that we found were about 90-percent oak, with poplar being used for the case back, drawers, sides, and so on. Some, of course, were constructed of mahogany.

To hold down the cost, we built ours

# Build PM's Victorian Sideboard

Crafted in the PM Workshop, this oak beauty is easier to build than you may guess. For validity, we used a finish that makes the piece look hand-rubbed.

BY HARRY WICKS HOME AND SHOP EDITOR

using solid oak for all exposed members. We economized by using  $\frac{3}{4}$ -in. plywood for interior partitions, carcass floor, the back and drawers. Purists, if they prefer, can use oak throughout, but such construction will drive up the cost considerably.

Before you start building, locate the nearest source of marble and make a trip there to discuss the various types of marble and their costs.

We used a rich-looking, handsome Italian marble on the prototype; the  $\frac{3}{4}$ -in.-thick slab—which was cut specially to fit the cabinet—cost \$150. The stone mason charged another \$40 to deliver the slab.

Once you know the marble you want, and its cost, you can start building your cabinet. *Do not* order the marble slab until you have finished building the cabinet. Once the carcass is assembled, you can measure

the top and have the mason cut the slab to suit your piece exactly. Because of

Design, construction, photography: Harry Wicks  
Wall covering: Apple Valley C5412, a strippable vinyl from Wall Tex Sampler Collection, Columbus Coated Fabrics, Div. Borden Chemical, Columbus, Ohio 43216



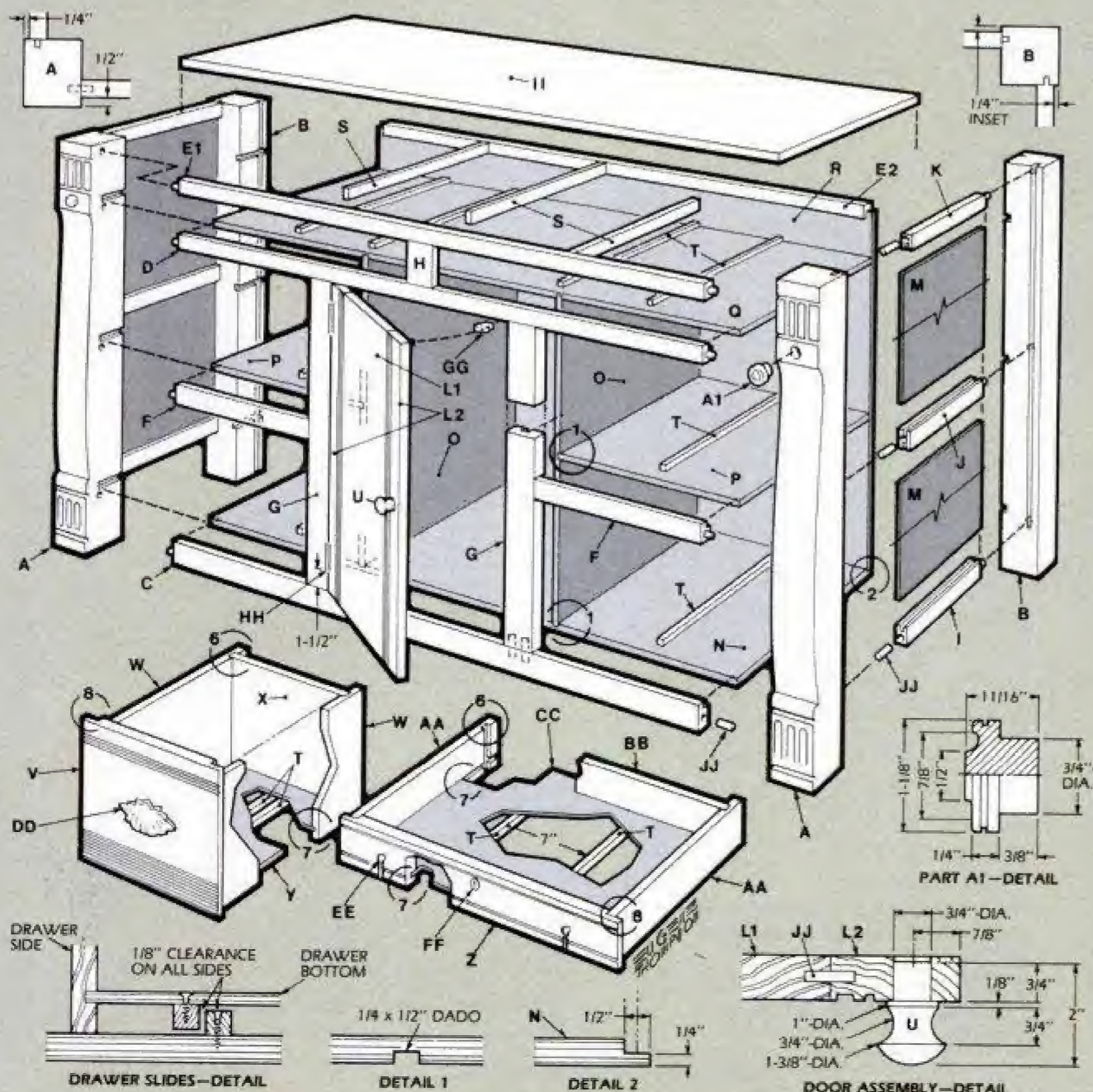
*Our elegant sideboard (often called a server) is created in oak and topped with  $\frac{3}{4}$ -in.-thick Italian marble.*



The next day, carefully



Using clamps and strips of wood, assemble a jig to hold the legs, one at a time, on your workbench. Using standard router procedures, set up the guides and stops for routing the vertical grooves at the top and bottom of each





leg. Do the stopped grooves using a core box bit.

The front faces of both front legs are shaped. To obtain the contour shown in the drawing, first make a pattern on  $\frac{1}{4}$ -in. hardboard. When you're satisfied with the shape, transfer it to both front legs to serve as a guide for your shaping step.

Secure the first leg in your bench-top jig and start the shaping, using a sharp spoke shave, Surform rasp, block plane and belt sander. I found that using the 3 x 21-in. belt sander with 80-grit paper helped to speed up the task considerably. The shaping of the legs is the most time-consuming aspect of the entire project. So, settle in and accept the fact that you will be doing it for a spell.

Bore the holes at front to receive the decorative turned buttons. Turn the

buttons on your lathe, using oak from the same stock that is used for the carcass. The button tenons should be cut for a neat—not loose—fit in their mating holes. Apply glue sparingly and insert button tenons into holes; lay legs on their back sides and put a weight atop each button. Allow to dry overnight.

Next, make up the side (end) assemblies. Carefully lay out for the dados which will receive the drawer shelves. Notice that the latter do not butt tightly against the panels. Since the wells will be occupied by drawers, the shelves merely serve as a base for the drawers.

### Assembling the cabinet

Assemble the cabinet as shown in the drawing. Dowels are used between rails and legs. And, since the piece will

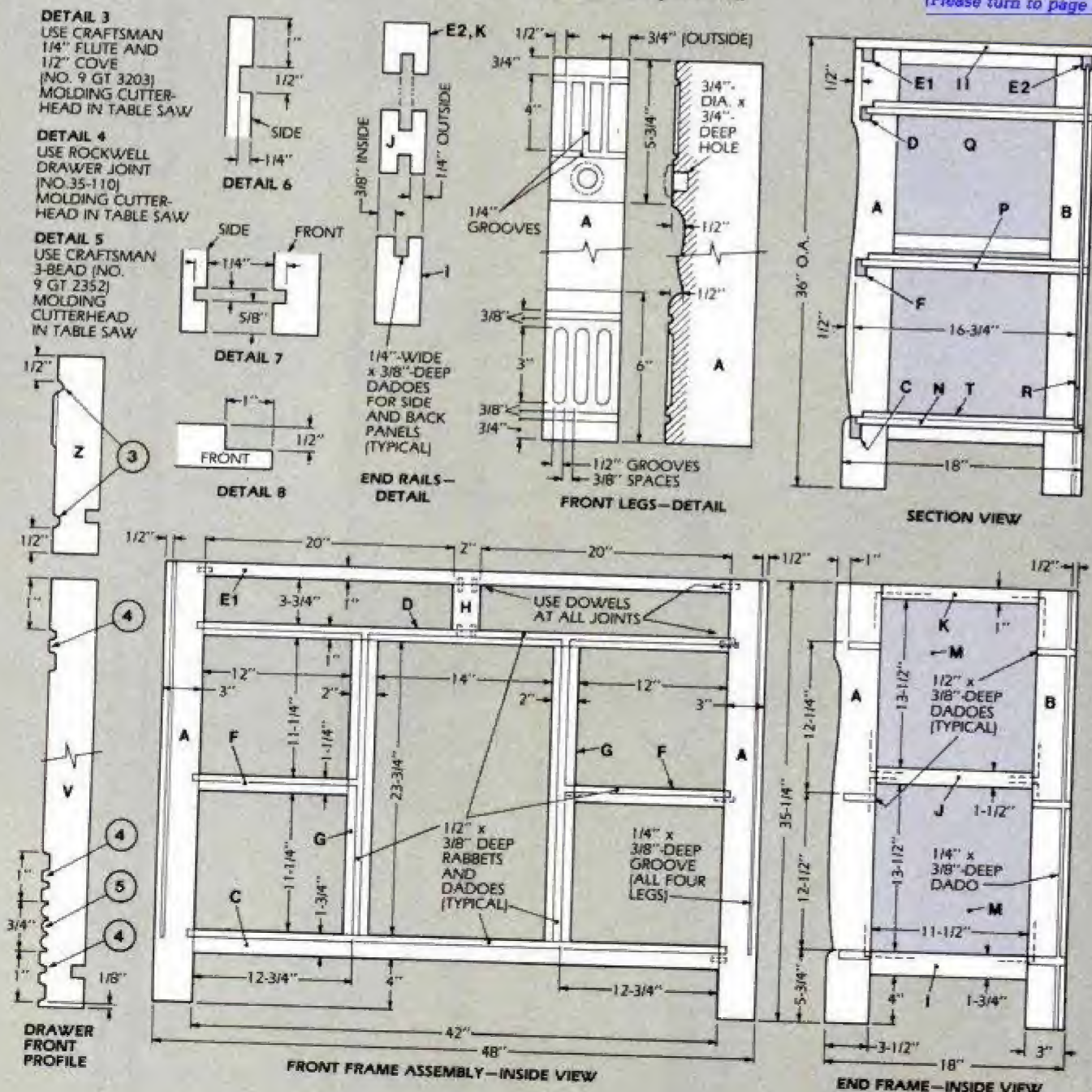
be topped by a marble slab, there is no need to install a top. However, do install the front-to-back pieces (S). These are needed to support the marble.

Once the cabinet is assembled, you can take measurements and build the drawers and door. Mark a number in an inconspicuous spot in each well and use the numbers on drawer backs to ensure that each is returned to its proper position in the cabinet.

All hardware on the cabinet is purchased. You can buy the hinges locally, but for authenticity, we found it was necessary to order the wooden and pendant pulls, knobs and key escutcheon plates from a couple of different sources. For your convenience, the suppliers are given in the materials list.

Do as the professionals do and get

(Please turn to page 203)

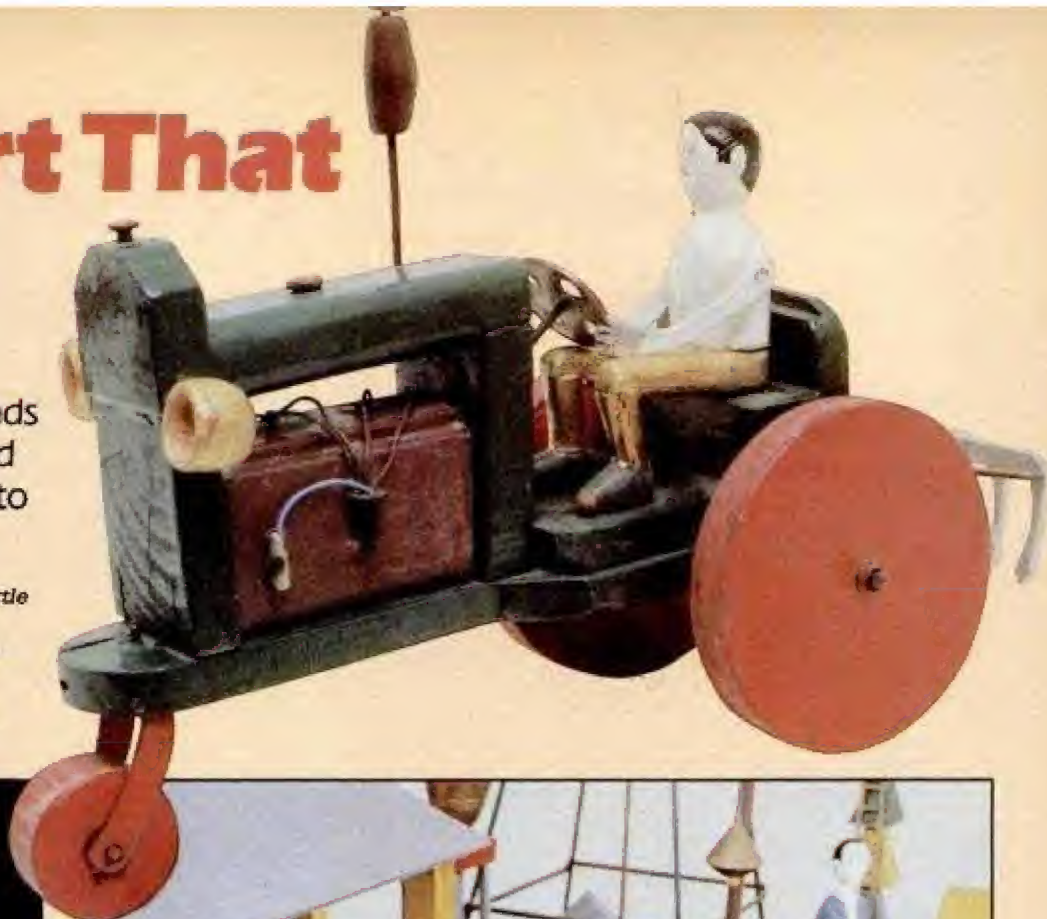




# Folk Art That Comes To Life

A native Georgian blends his woodcarving skill and his interest in machines to create this primitive art.

*Below: Carlton Garrett works on "Little Yellow Car"; colored wheels spin in "Machinery"; "Hospital" is Garrett's first work. Right: "Diesel Tractor" is from a series of farm equipment; "Waterworks" depicts a rural scene.*



**I**n a small back-yard building within view of his kitchen window, Carlton Garrett works in wood to recreate scenes of his past.

This old-timer not only saws and carves wood, but draws on his knowledge of mechanics to animate his work in very clever ways so that things are

not as they seem. Garrett's pieces depict scenes of rural Georgia and folk heroes. The figures in his work are animated by a motorized system boxed in below. Hand-carved wooden gears, cams, shafts and pulleys connected by strong cord bring his carvings to life. Often music accompanies the action.

"It's a wonder I wasn't killed many times," says the 83-year-old Garrett, recalling his childhood. Dangerous though it must have been, Garrett had the good fortune to have been born and raised near a water mill. He was fascinated by all the cogs and flywheels

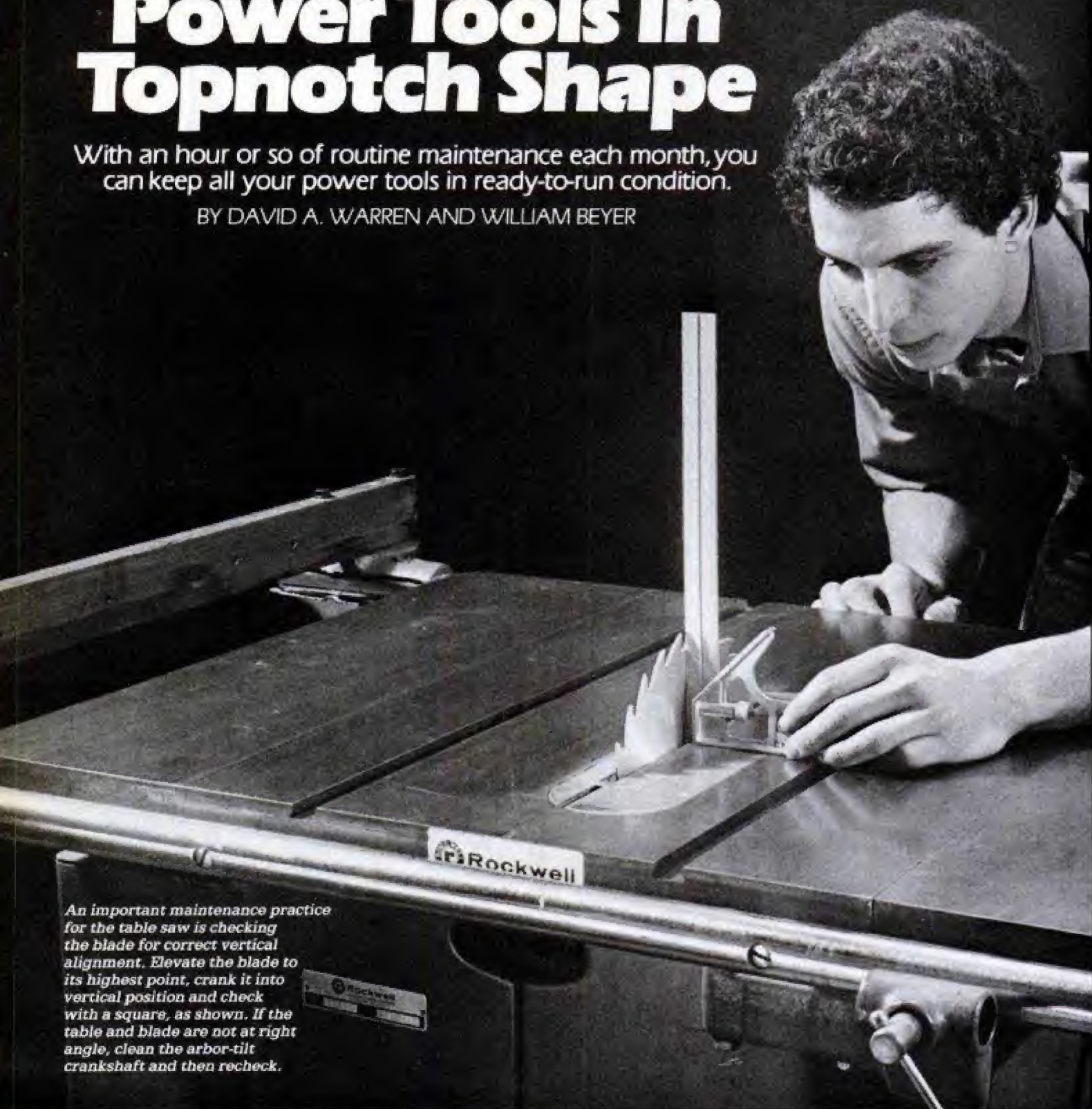
*(Please turn to page 206)*



# How To Keep Power Tools In Topnotch Shape

With an hour or so of routine maintenance each month, you can keep all your power tools in ready-to-run condition.

BY DAVID A. WARREN AND WILLIAM BEYER



*An important maintenance practice for the table saw is checking the blade for correct vertical alignment. Elevate the blade to its highest point, crank it into vertical position and check with a square, as shown. If the table and blade are not at right angle, clean the arbor-tilt crankshaft and then recheck.*

**T**o perform well, power tools must be maintained well. Following a routine maintenance program will prolong the useful life of your tools and help to ensure efficiency in your work.

The owner's manual for a given tool

is the most important maintenance guide, since it gives specific directions based on the design features of that tool. You should keep all of your owner's manuals on file in your shop.

In our captioned photos, we have compiled a general guide to the peri-

odic inspection, routine cleaning and regular lubrication techniques critical to proper maintenance. We've also zeroed in on specific problems to look

Lead photo: Rosario Capotosto  
How-to photos: Matt Doherty



# General Approach To Power Tool Maintenance

## PERIODIC INSPECTIONS



*Inspect power cords for fraying, especially at stress points near the ends. Also check the condition of plugs. Replace all frayed wires and plugs that have loose prongs.*



*Check condition of V-belts and replace if badly worn. Premature wear and belt slippage are symptoms of incorrect belt tension. Adjust belts so they're just tight enough to turn without slipping.*



*Using a straightedge, check drive wheels for alignment. Misaligned wheels will cause belt damage and strain motor.*



*Examine cutting edges for nicks, flaws and dullness. Poorly maintained (dull) knives and blades overwork motors and lower work quality. This planer knife needs to be ground and resharpened.*



*Test and tighten all screws, nuts and bolts that may have loosened from vibration. Replace stripped fasteners.*

for and correct with most of the common shop tools.

For safety, disconnect tools from the power source before making any adjustments. Clean up any lubricant spills immediately. Wear gloves for protection when cleaning sharp blades. **FM**



## ROUTINE CLEANING



Clear dust from air intakes. The best way is to blow it out with compressed air. If you don't have a compressor, get an aerosol can (such as Dust-off) at a camera shop.



Brush or blow dust from tools' nooks and crannies. With tool vibration, dust acts abrasively, causing undue wear.



Clean pitch and burn residue from blades with mineral spirits. Wear gloves to clean sharp edges like this jointer knife.



Clean chain drives with a solvent such as trichloroethylene, then lubricate the chain with WD-40 or light oil.

## REGULAR LUBRICATION



Squirt a few drops of light machine oil into oiling holes (left) to lubricate bearings that are sealed against dust.



Many older tools have oil reservoirs that should be checked every five operating hours and topped off. Drain oil every 100 hours and refill with clean oil.



Gears, such as the rack gear on this drill press quill, should be cleaned with solvent. Then, the gears should be coated thinly with axle grease.





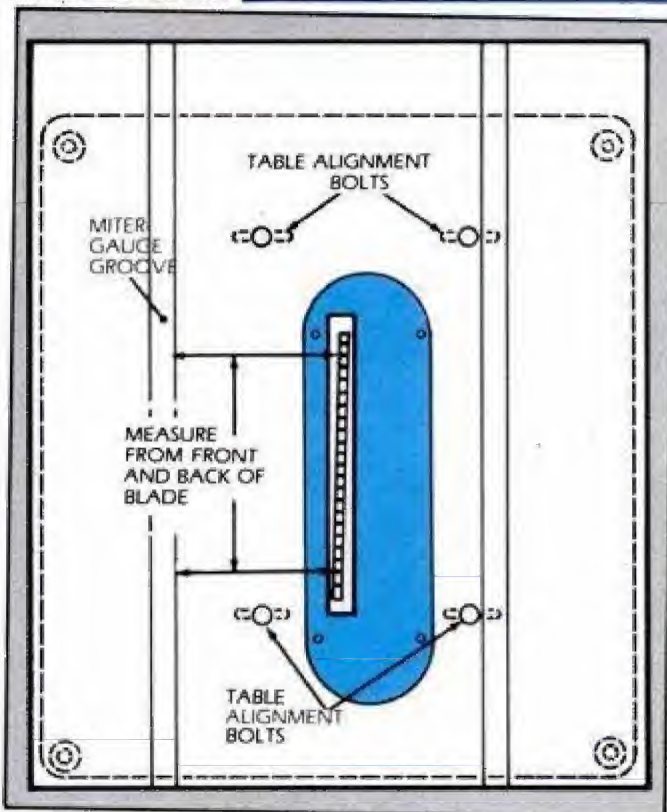
Rub a thin coat of light machine oil over metal surfaces to fill pores and prevent rust. If you find patches of rust, rub them clean with fine steel wool before oiling.



Lubricate surfaces such as this table saw top and fence that come in contact with work with WD-40. Don't use oil; it stains wood. Dirt can become impacted in a wax coating.

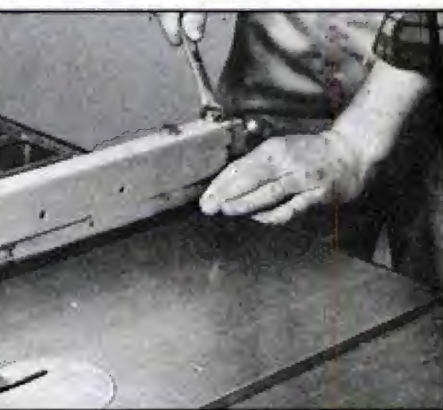
## Specific Maintenance Checks For Common Shop Tools

### TABLE SAW



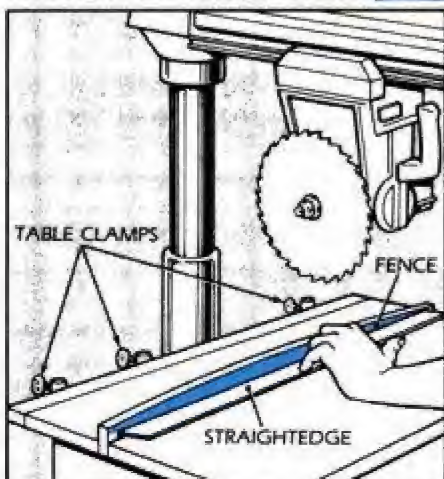
Check table-blade alignment as shown above. If adjustment is needed, look for alignment bolts on the underside of table.

Check miter gauge (right) by using a square to find the relation of the back-stop to the miter gauge slot. When they're at 90°, reset the pointer on the miter scale to 0.

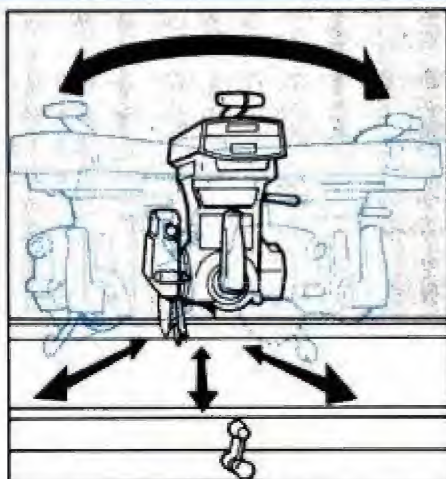


Set fence parallel to miter gauge groove (above) using bolts atop fence. Reset rip guide pointer (inset) for accuracy.

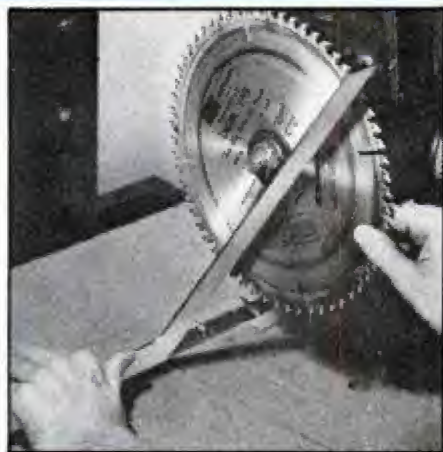
### RADIAL ARM SAW



Check fence for straightness and replace if necessary. On some models, clamps can be tightened to straighten bowing.



Set arm at various angles, move motor carriage along track. If blade doesn't touch table at all points, level table.



Use square to check for "too-in"—blade not parallel to line of cut. Correct with adjustments to carriage rollers.

(Please turn to page 196)



# WORKSHOP MINICOURSE



## More about dowels

Last month I discussed some of the basics of working with dowels. As I thought about this month's column, I realized that the entire doweling process is actually composed of a great number of "basic" steps. In other words, it's difficult, if not impossible, to define where the basics stop—and sophisticated joinery starts.

The simplest method of all for locating centers, for dowel holes on a mating board, is to use dowel centers (not shown). These little hat-like configurations are machined in the diameters to suit the most popularly used dowel sizes. To use them, you spot the dowel holes in the first board using ruler and pencil, and bore the holes. Then, you insert the dowel centers in the just-bored holes (with their nail-like points projecting out), align the mating board and press the two together. The pointy centers transfer the hole locations rather accurately so the dowel holes can be bored in the second board.

However, if you plan to do any serious furniture building, treat yourself to a reliable doweling jig. There are several types available, and many are first rate. Though I have used four different types of doweling jigs over the years, my "old reliable" is the jig shown. It's manufactured by General Hardware Mfg. Co., 80 White St., New York, N.Y., 10013. It is available at all well-stocked hardware stores and lumberyards. And, good instructions for using it are packaged with the tool.

When you work with a jig, you must first scribe match lines across the board face, as shown in the top photo at right. Make certain you always line up the jig from the same side of both boards; that way, if your guide (drum) is slightly off—that is, not centered exactly on the workpiece edge—the difference will be the same for both boards and they will still join without any problems.

Several important points:

■ Never use too much glue—always work with a scant amount.

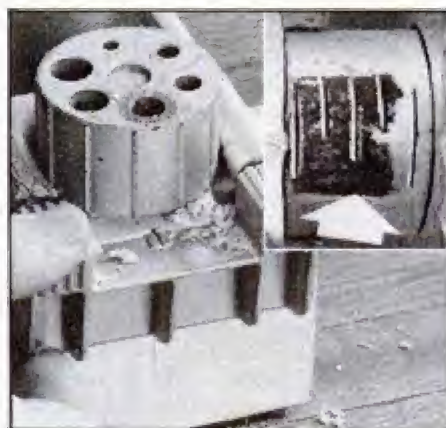
■ Keep glue away from board edges. This practice, coupled with the right amount of glue, ensures well-joined boards with little or no glue squeeze-out.



**1** Boards to be joined with dowels are aligned, then marked carefully using a square and sharp pencil across the joint. On hardwoods use an awl for this marking step.



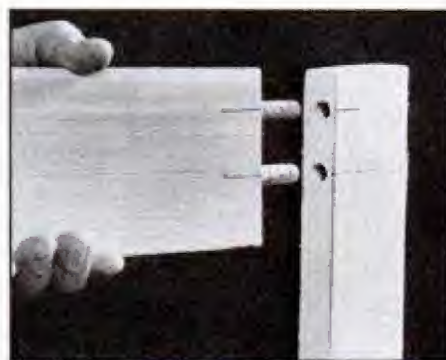
**2** This is author's favorite doweling jig. First step is to rotate head or drill guide (A) so correct size bit can be used. Here, because  $\frac{3}{4}$ -in. stock will be joined with  $\frac{3}{8}$ -in. dowels, we use a  $\frac{3}{8}$ -in.-dia. bit. When  $\frac{3}{8}$ -in. guide hole is aligned, secure drum by tightening nut (B).



**3** Next, drum is moved to position  $\frac{3}{8}$ -in.-dia. hole at center of  $\frac{3}{4}$ -in. stock. Increments are in  $\frac{1}{16}$  in. (arrow).



**4** Use either a brad or spur-point bit to do the boring. Affix a masking tape flag on bit to ensure correct depth.



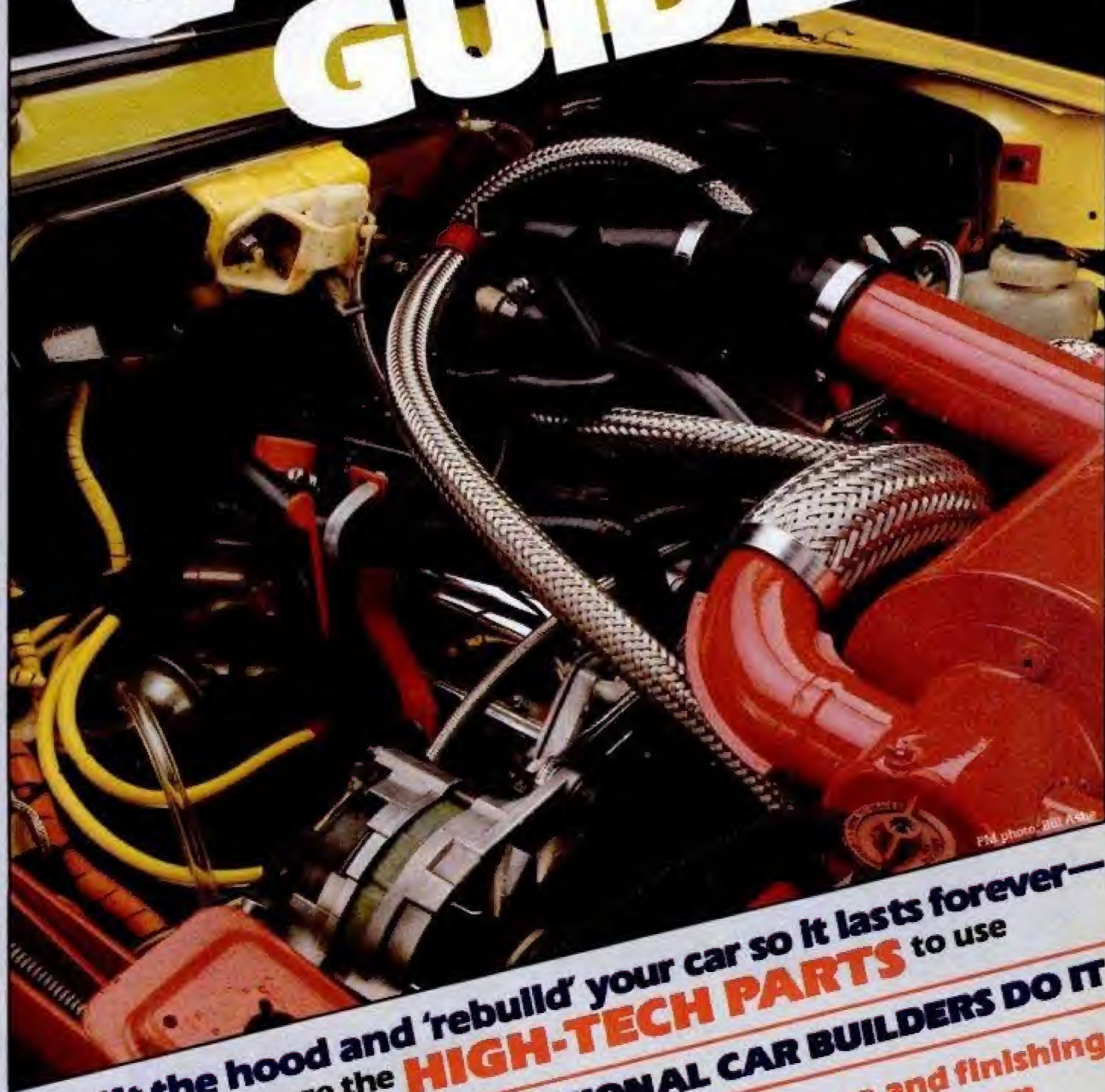
**5** Repeat hole-drilling procedure on mating piece. Then test parts for fit without glue. For final assembly, join parts with scant amount of glue on dowels. Clamp assembly overnight.



Popular  
Mechanics

'83

# CAR CARE GUIDE



PM photo: Bill Ashe

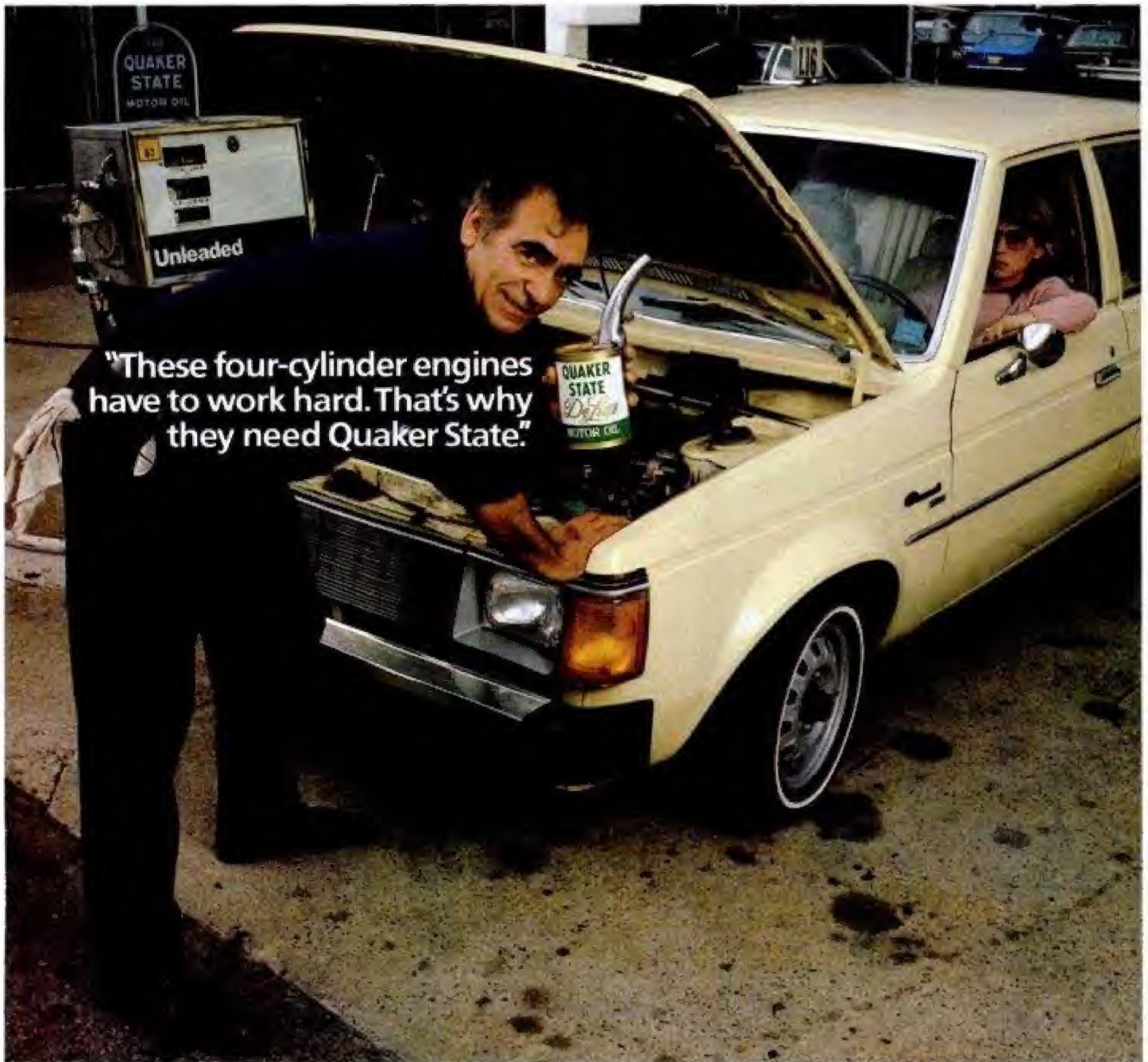
Lift the hood and 'rebuild' your car so it lasts forever—  
Here are the **HIGH-TECH PARTS** to use

**HOW THE PROFESSIONAL CAR BUILDERS DO IT**

Plus: Rust-fighting, fix-up and finishing  
tips to keep your car from  
growing old



# "Today, you need an oil this good."



"These four-cylinder engines have to work hard. That's why they need Quaker State."

Small engines deliver good gas mileage. But to give you the kind of performance you want, they have to work extra hard. They need Quaker State quality. These Quaker State motor oils are made exclusively from Pennsylvania Grade Crude Oil. They offer quality protection for any kind of car—old or new, big or small. Quaker State. It's so good, it's America's best selling motor oil.

## Quaker State



Motor oil is a trademark of Quaker State Oil Company.



# CAR CARE GUIDE



Cover: Immaculate redo of engine box in LeCar.



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The Secret To Keeping Your Car Running Forever

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- How to repair a rusted battery tray
- Restoring rusted headlight buckets
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#### EXHAUST

- How to install a free-flow exhaust system
- Replacing sheet-metal screws

Sources and Suppliers  
New Car Care Products

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Car Care Guide produced by PM Auto Dept. Guide designed by Don Mannes. PM Photos: Peter Tenzer. Car Care Guide Cover Photo: Bill Ashe. Illustrations: Jeff Mangiat.



# How The Pros Rebuild A Car

**M**ost of them are racing mechanics, some are racing drivers; almost all are graduate engineers or designers. Their shops tend to be large, lined with expensive machine tools and brightly lighted. A couple of assistants clad in immaculate overalls confer quietly over a brand-new car with its guts exposed, while two or three more exotics wait to be similarly disassembled. The phones ring incessantly with calls from suppliers and customers.

This is the seductive world of the Supertuners, men who can take almost any mass-produced car and—for a

price—turn it into something special. Typically, they specialize in one brand of car—Porsche, BMW, Ferrari at the pricey end, Camaro, Volkswagen, Datsun at more affordable levels. What they do is “narrow its focus”: improve the handling, the acceleration, the comfort, the appearance, the reliability.

These Supertuners are emphatically not building “race cars for the street.” Racing can teach you about performance and aerodynamics and durability, but a balanced, real-world passenger car is a much more difficult package to develop. In the end, what separates a

Supertuner from a racer is that he can make a production car more exciting to own, without destroying its usefulness as transportation.

Probably the best Supertuner in the world is a soft-spoken marketing genius named Rainer Buchmann. Buchmann is a far-sighted internationalist, given to throw-away lines like “I don’t hire anybody who’s not fluent in at least three languages.” His B+B Auto Exklusiv is located in Frankfurt, West Germany, but his well-heeled clientele spreads all over the world.

Buchmann’s conversation is sprin-



**TURBO CAMARO**  
Bill Mitchell



*This Camaro reworked by Bill Mitchell has a turbocharged 350-cu.-in. V8 (inset) totally new suspension, Minilite magnesium wheels and aerodynamic body work based on Penske/IROC cars. Rainer Buchmann, who heads B+B, carved this Porsche 928 into a convertible. The \$100,000 rebuild has a beefed-up chassis, Recaro interior and state-of-the-art, onboard computer system.*



**PORSCHE 928**  
B + B Auto Exklusiv





kled with thoughts about "lifestyle" and "total design for living," and in eight years he's progressed from a two-man shop behind a Frankfurt filling station to a 40-man industrial complex working on some 400 cars per year. He's even talking about a second shop, to be located in Newport Beach, Calif.

B+B's products range from a one-off complete car—the Cw 311—to a matching perfume/cigarette lighter/electronic ignition key set distributed by Pierre Cardin. He's developing his own variable-displacement engine—a first step to building a limited-production B+B car—and doing design work for Volkswagen and other European automakers.

But the heart of B+B is Porsche conversions for private customers. Most popular is a 928 Convertible, which adds 80,000 DM (about \$40,000) to an already exalted price. As with all of Buchmann's cars, the attention to detail



**POLO CARAT**  
B + B Auto Exklusiv



**TURBO CORVETTE**  
Duntov

**PORSCHE 930  
KREMER  
ACI**

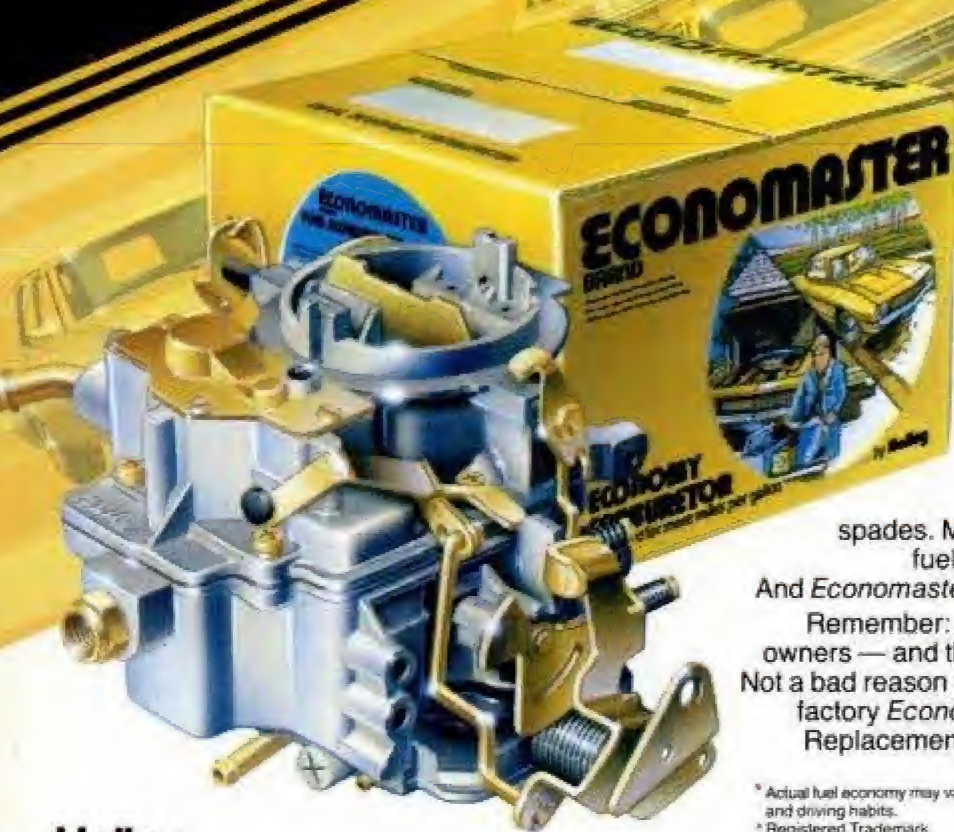


*Kremer's Group 5-S conversion is a Porsche 911SC with blueprinted engine, racing suspension and fiberglass body work. B+B's Polo Carat (top) was built for Volkswagen. It includes fiberglass bodywork, digital instrumentation and remote-control burglar alarm and ignition switch. Duntov's turbo Corvette has been turned into a convertible, given new fiberglass bodywork and a new interior with digital instrumentation.*



# BRAND Economaster No Previous Owners

## Holley



When you bolt on an *Economaster*<sup>®</sup> brand carburetor from Holley,<sup>®</sup> you bolt on the best value for your dollar. New carburetor efficiency and proven reliability. And that's something you can't always say about a "hope-for-the-best" rebuilt.

An *Economaster* carburetor costs much less than many original equipment replacement carburetors, too. Yet it delivers improved performance and driveability in

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Remember: *Economaster* carbs have had no previous owners — and that means no little performance surprises. Not a bad reason for you to always specify a fresh-from-the-factory *Economaster* carburetor for your engine. Holley Replacement Parts Division, 11955 E. Nine Mile Road, Warren, Michigan 48090.

\* Actual fuel economy may vary due to application, engine and driving conditions, engine modifications and driving habits.

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Makes Fuel Efficient**

## Holley

Replacement Parts Division

Colt Industries





# CAR CARE GUIDE

is uncanny. The Porsche's chassis is completely reworked to handle the trauma of having the coupe top cut off. The body is brought up to B+B, rather than Porsche, standards before being repainted. Recaro upholsters seats in B+B's own cloth and a resident electronics expert fits each interior with a dazzling array of micro-chip gear.

For \$100,000, Rainer Buchmann is really selling style, not convertible Porsches. His ultimate goal, he confides, is to provide his select customers with not only a car, but clothing, furniture, consumer electronics and hous-

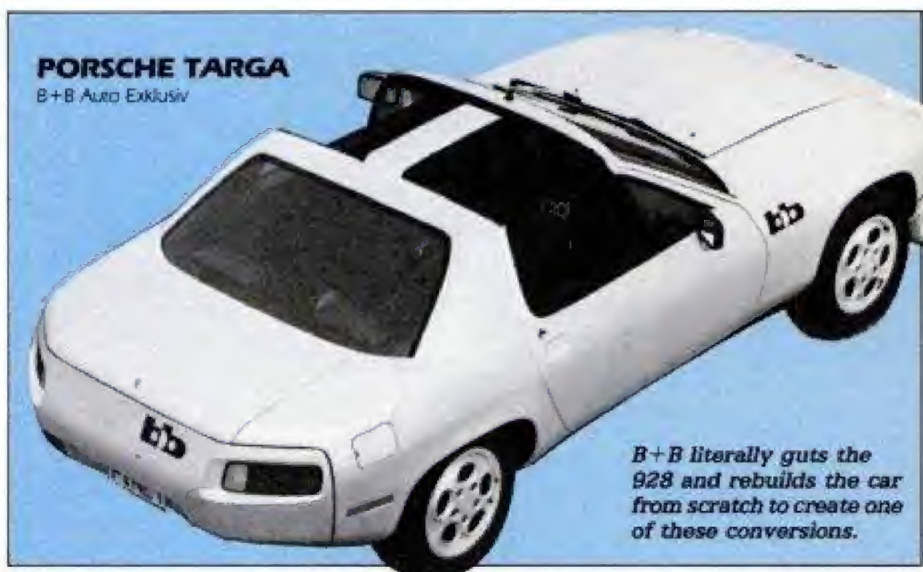


**LAMBORGHINI COUNTACH** *Ad*  
Lamborghini Countach is federalized and bespoiled by ACI. It's powered by a fuel-injected, 12-cylinder engine.

ing—a total environment—all designed by Rainer Buchmann and built to his impeccable standards. His associations with Pierre Cardin, Lanvin and Paris Vogue are just a beginning.

At the other end of the marketplace is Bill Mitchell of Special Vehicle Developments in Cheshire, Conn. When we first met Mitchell in 1978, he was fixing up Firebirds in his basement garage. Nowadays, this former GM suspension engineer and racing driver has a spacious shop where he and his assistants turn out 100 cars a year for a largely word-of-mouth clientele.

Not surprisingly, Mitchell concentrates on GM suspension work. He changes the geometry for crisper road feel and straighter tracking, fits specially valved Koni shocks built to his own



**PORSCHE TARGA**  
B+B Auto Exklusiv

*B+B literally guts the 928 and rebuilds the car from scratch to create one of these conversions.*

specifications and ultralight tires and wheels to minimize unsprung weight. And it works. A Mitchellized Z-28 or Trans Am feels as solid as a Mercedes; his GM X-cars will run rings around a BMW 320i.

Mitchell also specializes in turbocharging the Chevrolet small-block V8, in either gasoline or diesel form. And despite their Racemark interiors, fancy sound systems and ground-scraping air dams, his cars have an understated competence about them, very different from the flashy, expensive look favored by Rainer Buchmann.

Bill Mitchell is also surprisingly reasonable. Compared to a \$100,000 B+B Porsche, his \$15,000 turbocharged Camaro is a bargain—especially since it delivers surprisingly similar performance, with enviable reliability and genuine style.

One of our favorite Supertuners fits somewhere between the beautiful people of B+B and the straightforward performers of Bill Mitchell. He's Brian Morrow of San Jose, Calif., who builds Scarabs. What's a Scarab? Well, Morrow takes a brand-new Datsun 280 ZX, and disassembles it. He beefs up the

chassis, then puts in a completely new suspension system, bigger disc brakes and a turbocharged Chevrolet V8.

To cover wider tires, Morrow flares the fenders; to allow room for the V8, he scoops the hood; to blend it all together, he applies his own special paint job. The final touch is a whole new interior, more in keeping with what has become a very fast, quite expensive piece of machinery.

Depending on how elaborately you get carried away, a Scarab will set you back \$10,000 to \$15,000—above the price of a new Datsun, of course. On the other hand, this 425-hp coupe will run away and hide from Corvettes, Porsches and the like, and has proven to be remarkably durable. Morrow has built hundreds of these cars over the past decade, and he has the whole thing down to a science.

There are a couple of dozen American Supertuners, all told, each with his own specialty. Reeves Calloway is a demon with VW Rabbits, especially those with turbochargers. Bob Sharp is the acknowledged Datsun expert, Dick Guldstrand knows more about high-performance Corvettes than any man

## DATSUN 280Z *Scarab*

*Re-powered by a Chevy small-block V8, Datsun 280Z performs awesomely after Scarab gets through with it.*





## Remember Traditional Maintenance

**T**here's a lot of glamour in professional car building, but even the pros don't forget the routine work. And high-technology retrofit parts notwithstanding, the traditional maintenance procedures are still an important part of any durability and reliability program.

The maintenance schedule below is our advice on how to keep your car on the road and out of the shop. Like the *Car Care Guide* that follows it's a little bit of overkill, but according to the many readers who have put anywhere from 165,000 to 200,000 miles on their particular car, it's a schedule that works. We've based this schedule on their experience.

You'll notice that this schedule is broken down by time rather than mileage, and doesn't give specific oil change intervals. That's because the mileage you put on your car in a year won't be the same as your neighbor's. The guideline you follow should still be the hallowed 3,000-mile interval. Yes, we know all about the new cars and their extended oil change and filter change interval, but if you read the fine print it still comes down to 3,000 miles. In most cases where a 7,500-mile oil change is recommended, the fine print includes "except in dusty driving conditions, frequent short trips, stop and go city driving, driving in heavy traffic in extremely cold or extremely warm temperatures, etc."

When you get through reading the exceptions, you'll realize that the only people who can take advantage of the 7,500-mile oil change are those few lucky individuals who pull out of their driveway in the morning, cruise at 55 mph on a traffic-free highway for an hour at a 89° F. ambient temperature. The point is, you'll never go wrong by sticking to 3,000-mile oil and filter change. Yes, the filter, too.

In the schedule you'll also notice we mention waxing a car only twice a year. That's the minimum. Washing a car is another matter entirely. Wash it as often as you can. Mild detergent and water, lots of it, can only do your car good. Depending on where you live, you might have to take extra precautions. Some parts of the country (Michigan Cancer, Monterey Road Rot) are notorious for their appetite for sheet metal. Our first section in the Guide deals specifically with how to rustproof your car.

A vehicle log book can be as elaborate or as simple as you like. We've met owners who keep a log the size of a phone book complete with their annual chassis dyno charts and distributor curve plots. You needn't be that detailed. A small notebook with a record of service performed and oil change history should be enough.

### PM's MAINTENANCE SCHEDULE

#### Weekly—½ hour

- Check oil level.
- Check transmission fluid level.
- Check coolant level.
- Check brake fluid level.
- Check windshield wiper fluid level.
- Check hoses and belts.
- Check battery electrolyte level (in unsealed batteries; check eye color in sealed batteries).
- Check tire pressure, tread condition.

#### Monthly—2 hours

- Make all weekly checks plus:
- Lubricate all hinges, seat runners and so on.
- Lubricate carburetor linkage.
- Make coolant hydrometer test.
- Make battery specific gravity test.
- Lube ball joints (if applicable).
- Check sparkplug condition and gap.
- Check distributor cap and rotor.
- Check fuel filter.
- Check air filter and housing.
- Check air cleaner thermostat.
- Check vacuum hoses for cracks.
- Check weatherstripping, trim and moldings.
- Vacuum and shampoo carpets.
- Treat vinyl or leather.

#### Twice a year—5 hours

- Reverse flush cooling system.
- Pressure-test cooling system and radiator cap.
- Grease wheel bearings.
- Check brake pads for wear.
- Bleed the brakes.
- Change automatic transmission fluid.
- Make a compression test.
- Check engine timing and adjust if necessary.
- Remove, clean and load-test the battery.
- Test sparkplug wires for resistance.
- Inspect suspension bushings.
- Bounce-test shock absorbers (struts).
- Rotate tires (if applicable).
- Have wheel alignment checked.
- Check clutch, brake and accelerator pedals for free play.
- Inspect exhaust system for rust, loose hangers. Check condition of undercoat.
- Degrease or steam clean engine compartment.
- Wash and wax the body.

If you total up the time we estimate for these procedures, it comes to 60 hours a year. That sounds like a lot. But if you break it down into a half hour per week and two hours per month, it's a manageable number. You'll find also, that once the weekly and monthly checks become routine, you'll be able to breeze through them. The more familiar you are with your car, the easier it will be to spot possible problems.

alive, Richard Gordon is the Volvo man, partners Allen Hardy and Hans Beck are the source of quick BMWs.

Interestingly, all the successful Supertuners follow pretty much the same formula, no matter which passenger car they're improving. The suspension and brakes inevitably need beefing up. Tires get wider and stickier, an air dam grows beneath the front bumper. The interior sprouts Recaro seats, a leather-wrapped steering wheel, an expensive sound system and a sophisticated on-board computer. The turbocharger is their favorite way of adding horsepower, which usually means a thorough reworking of everything between the radiator and the gearbox.

There's a common thread running through here. Every Supertuner uses the best components he can find—BBS wheels, Recaro seats, Koni shocks, Aeroquip stainless-steel hoses—and if he can't find what he needs, he'll make it from scratch. They all seem to start with the chassis and fine-tune that before they dump in 500 hp. And they're on top of the newest technology in aerodynamics, electronics and radial tires.

If there's a path to Supertunerdom, it's paved with details.

These pros rebuild cars to earn a living. The rebuild you do on your own car—detailed in the pages that follow—will enable you to take more pride in your set of wheels and help you get many more years of service from it. **PM**

### WELL-KNOWN SUPERTUNERS

American Custom, 5035 Alexis Rd., Sylvania, Ohio 43560  
 Amerispec, 86 Mill Plain Rd., Danbury, Conn. 06810  
 B + B Auto Exklusiv, Orberstrasse 5, 6000, Frankfurt-am-Main 61, West Germany  
 Bob Sharp Datsun, Route 7, Georgetown, Conn. 06829  
 Calloway Turbo Systems, High St., Old Lyme, Conn. 06371  
 FAZA, 2438 South Ridgewood, Daytona, Fla. 32019  
 GMP, Box 240008, Charlotte, N.C. 28224  
 Guldstrand Enterprises, 11924 West Jefferson, Culver City, Calif. 90230  
 Hardy and Beck, 1799 Fourth St., Berkeley, Calif. 94710  
 Herman + Miller, 250 Route 46, Parsippany, N.J. 07054  
 Holbert Racing, 1425 Easton Rd., Warrington, Pa. 18976  
 Huffaker Engineering, 1290 Holm Rd., Petaluma, Calif. 94952  
 IPD, 2762 Northeast Broadway, Portland, Ore. 97232  
 Kurrus Motor Works, Box 633, Pleasant Valley, N.Y. 12569  
 Miller and Norburn, 2002 East Feabody, Durham, N.C. 27703  
 R and A Applied Arts, 701 Riverside Ave., Lyndhurst, N.J. 07071  
 Scarab, Box 9217, San Jose, Calif. 95157  
 Special Vehicle Developments, 337 Blacks Rd., Cheshire, Conn. 06410  
 Turbotek, 87 Elm St., Cohasset, Mass. 02025



# ***The Dayton Thorobreds are with you...***

## ***mile after mile.***

With a full stable of famous Thorobred radials... including the steel-belted Blue Ribbon, the all-season Quadra and the wide track Daytona. Great radials for virtually every car and light truck on the road.

From coast to coast, our national dealer network is over 3,000 strong, to provide you full service and support. Check the Yellow Pages for the dealer nearest you and ask him about our written mileage warranties that help protect you and your investment.

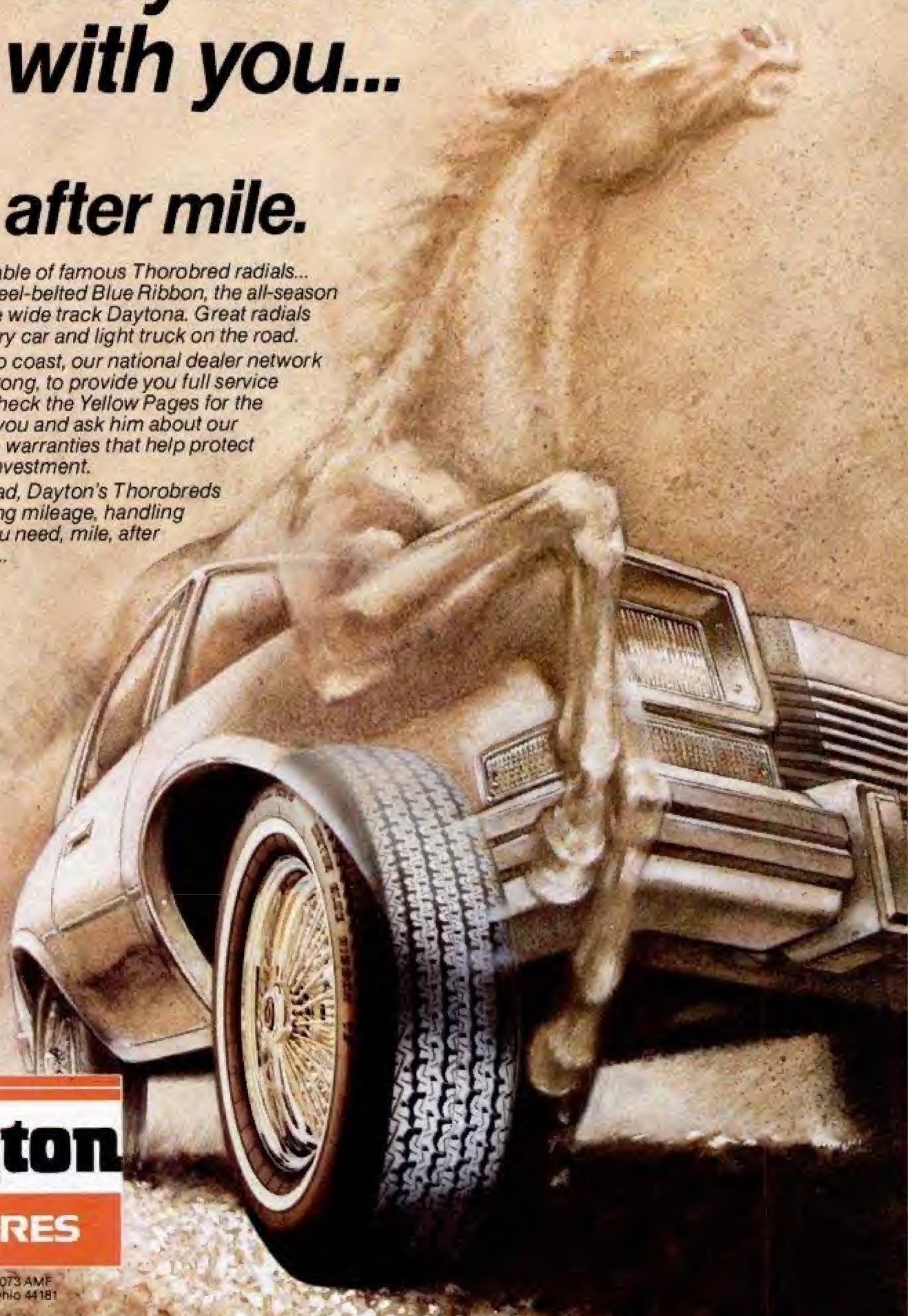
Down the road, Dayton's Thorobreds give you the long mileage, handling and traction you need, mile, after mile, after mile...

# **Dayton**



## **TIRES**

P.O. Box 81073 AMF  
Cleveland, Ohio 44181

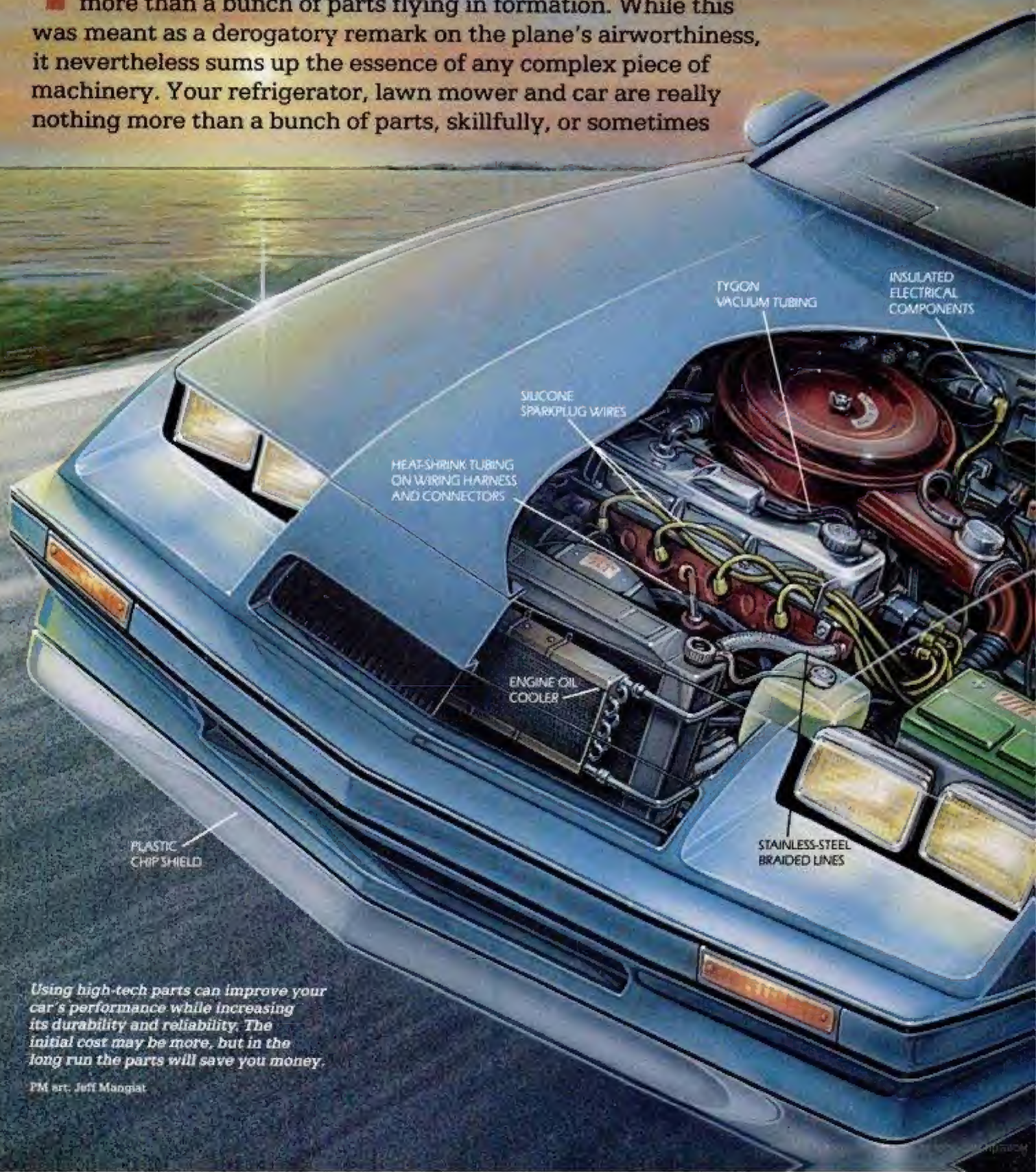




# HIGH-TECH PARTS

**THE SECRET TO KEEPING YOUR CAR RUNNING FOREVER**

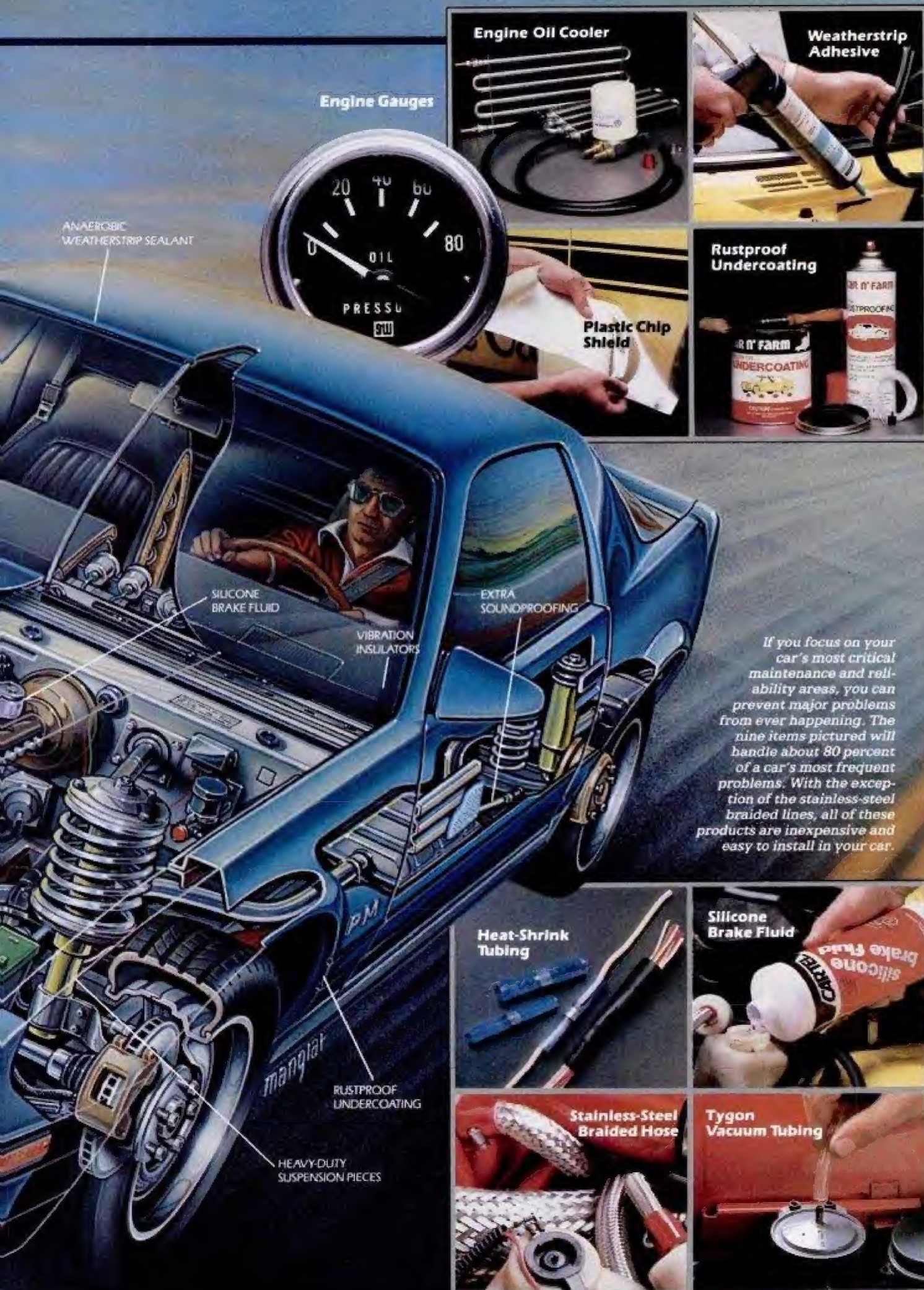
**T**hey used to say of the old Jenny biplane that it was nothing more than a bunch of parts flying in formation. While this was meant as a derogatory remark on the plane's airworthiness, it nevertheless sums up the essence of any complex piece of machinery. Your refrigerator, lawn mower and car are really nothing more than a bunch of parts, skillfully, or sometimes



*Using high-tech parts can improve your car's performance while increasing its durability and reliability. The initial cost may be more, but in the long run the parts will save you money.*

PM art: Jeff Mangiat





Engine Gauges

Engine Oil Cooler

Weatherstrip Adhesive

ANAEROBIC WEATHERSTRIP SEALANT

Plastic Chip Shield

Rustproof Undercoating

SILICONE BRAKE FLUID

EXTRA SOUNDPROOFING

VIBRATION INSULATORS

RUSTPROOF UNDERCOATING

HEAVY-DUTY SUSPENSION PIECES

Heat-Shrink Tubing

Silicone Brake Fluid

Stainless-Steel Braided Hose

Tygon Vacuum Tubing

If you focus on your car's most critical maintenance and reliability areas, you can prevent major problems from ever happening. The nine items pictured will handle about 80 percent of a car's most frequent problems. With the exception of the stainless-steel braided lines, all of these products are inexpensive and easy to install in your car.





**FASTER THAN A FLUSHED QUAIL.  
MORE POWERFUL THAN A GIANT MUSKIE.  
ABLE TO LEAP RUSHING STREAMS IN A SINGLE BOUND.  
TOO BAD IT WON'T START.**

Why put featherweight parts in a heavy-weight machine? This fishing season look for this sign at participating stations, garages and NAPA stores. And keep your beast of a machine running super strong with tough NAPA parts. Or your fishing trip could come to a standstill.



Check Your Yellow Pages



(Continued from page 120)

not so skillfully, crafted to accomplish a certain design goal.

The key word here is parts. And it's the parts, and their relative weaknesses or strength, that determine your car's reliability and durability.

We have quite an ambitious goal in this year's Guide. Some of the parts mentioned are unfamiliar to most of you and, we would say, to most professional mechanics, as well.

What we've done is analyze every system of an automobile to come up with a way of preventing a failure which experience tells us will, in time, occur. If we couldn't find an answer in the conventional auto industry and aftermarket, we searched farther afield to other, unrelated, industries.

The solder-sleeve connectors and adhesive-line, heat-shrink tubing, for instance, had never been used in an auto application before. Until we got hold of them, these items were restricted to more esoteric uses, like wiring up the Lunar Lander and NASA's Space Shuttle.

The same goes for the Tygon tubing. This item has been used extensively in the chemical, food processing and medical fields. It remains pliable and resists cracking in temperatures ranging from -100° F. to 400° F.

## The big guys can't do it

You might legitimately ask why the car companies can't do this. Why can't they make cars that last indefinitely and save you a lot of trouble and expense? The answer is simply economics. They could and would, if you were willing to pay a lot more for a car than you do now.

Take a radiator hose, for example. As it comes installed out of the factory, it will give you a "reasonable" service life. It will cost the maker a hypothetical 50 cents to buy and install. When its service life is over, it will cost you a few dollars to replace and everybody's happy. For a maker to try and double that "reasonable" service life it might cost him, say, another 20 cents. But that seemingly small extra investment by a maker, when multiplied millions of times, will quickly boost the price of a car beyond competitive market business. The car may last forever, but no one would buy it to appreciate it.

Realistically, as a car owner, you're in a better position than a manufacturer to optimize a car's systems. By investing wisely in quality replacement parts after the original parts wear out, you literally could have a car that you could pass down to your great-grandchildren.

Before you embark on any durability program, analyze your car and all its systems. Different models are prone to different reliability problems and not everything in the Guide will apply to all cars. The areas we've picked out for examination and improvement, however, seem to be the most universal.

Rust, for instance, is a problem everyone faces eventually. Yet, it's one of the cheapest and easiest to cure.

Your best guide to sorting out the critical problem areas is your previous

experience with cars. For instance, have you ever known the paint on an air cleaner housing not to flake off? Or a vacuum line that didn't get hard and crack? Or rocker panels that didn't get shot-peened by road debris?

Racers call it bulletproofing. Build a race car, drive it hard until something breaks, fix it and make it better, then drive it more. In passenger cars, we all *know* what will fail. And bulletproofing those parts we know will fail is what this *Car Care Guide* is all about. **PPM**

# LONG TERM INVESTMENT THAT PAYS OFF NOW

Right from the start, they'll help you do the job easier, faster, better. Years from now, they'll still be giving you like-new efficiency. Tools by CHANNELLOCK. Precision made by specialists who've been forging only the best for almost a century. Send for free catalog. Channellock, Inc., Meadville, Pa. 16335

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# '83 CAR CARE GUIDE



Total rustproofing can be a one-weekend home garage project. Metal primer and a rustproofing compound are all you will need. Removable fenders (right) make it easier.



## How To Stop Rust Before It Starts

**R**ust is your car's single biggest enemy. It's a silent killer that can frustrate all the meticulous care you devote to engine and mechanical maintenance. The problem with rust is that by the time the first telltale brown bubbles begin to break through the paint, it's too late. Rust already has a firm hold on the body.

Professional rustproofers will not touch a car that's older than three

months. They know that even in that short a time out of the showroom, rust has already begun to form, and all the rustproofing they spray on top of it won't stop the advance of the body cancer.

But whether your car is brand new or half a decade old, you can stop galloping rust. All it takes is time, elbow grease and some really inexpensive materials.

The first step is to find where rust lives. You'll usually find it where water has a place to enter and puddle up. Look in the bottom of the trunk, inside the doors, at the rocker panels, inside fenders, beneath the carpeting on the floorpan and around the battery. You'll also find it behind trim, body moldings and around windshield and rear glass moldings.

Once you've identified where the



Rust forms where water collects, as here between the fender and body. After three winters, this car was ready for repair.

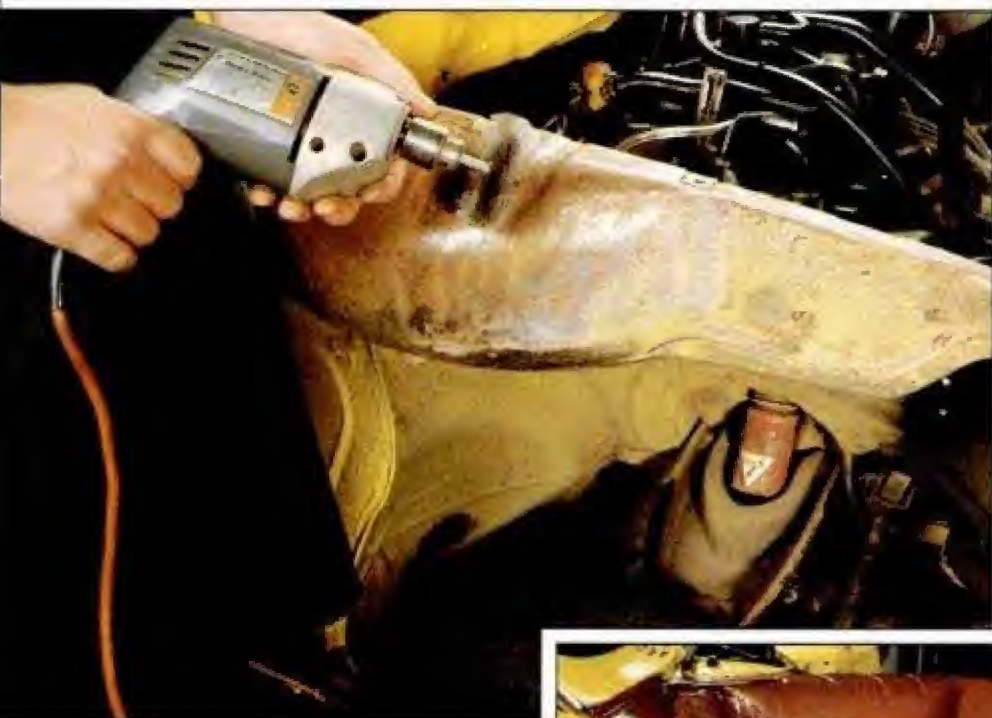


Loose scale can be removed quickly with a gasket scraper. Get off as much as you can before going to the wire brush.



The wire brush will usually be enough to get down to the bare metal. It will reach places the gasket scraper can't get.





*A wire brush chucked into a power drill does job quickly. However, it blows a lot of dust around, so wear a mask if you plan on using this method. When you see a shiny metal surface you know you've cleared out all the rust.*



*Degrease surface with good solvent (top). Once surface is dry and clean, apply two coats of red metal primer (above). When primer is dry (left), you apply top coat of thick rustproofing material.*



rust is, you'll need a gasket scraper, a stiff wire brush and a round wire brush chucked into an electric drill.

Get off as much of the loose rust and scale as you can with the scraper. Then use the hand wire brush to get down as far as you can to the metal. This will usually be enough to get to bare metal, but there are some areas you can't reach with the brush. For those spots you'll have to use the power drill to get down to bare metal.

Work a small area at a time and make sure you get all the rust. Also make sure you can finish the job the day you start. Leaving bare metal untreated for any length of time—even overnight—will only start the rust process once again.

Once you've got a nice, clean area of bare metal, wash it down with a rag and a trichloroethane degreaser. This will leave a clean, grease-free surface and will allow the first coat of red metal primer, such as Rust-Oleum, to bond properly. The lead has been taken out of red lead oxide, but its successor is just as good. Two coats of red primer

will be enough. Give the first coat a half hour to dry before applying the second coat. Make sure you leave no patches of bare metal. This will defeat your effort.

Rust-free painted surfaces near the rusted areas you're working on don't need to be treated with the red metal primer; the rustproofing material will be enough. However, you should clean the surface as much as possible with

the degreaser. This is especially critical in areas that tend to collect lots of grime, like the inside of fenders. Surface dirt and grime will only create a barrier between the painted surface and the rustproofing material you'll be applying.

Once you have the painted surfaces clean and the bare metal surfaces painted with red primer, it's time for

*(Please turn to page 127)*



*Drain holes in doors are prone to clogging. Use the spray-type rustproof coating with the extension nozzle for treating hollow, toughly and treat the inside of the door inaccessible body cavities.*





INTRODUCING THE ALL NEW TRIM-SIZE

# FORD BRONCO II



IT'S A BRAND NEW KICK!!



30 (20)

City (20) mpg. Actual mileage may vary depending on driving conditions and vehicle load. Always wear your seat belt.

FORD



Trim new 4-wheeler seats four, has split fold-down rear seats for extra cargo. Easy to park, fun to drive, it's a brand-new kick — on the road and off!

Built Ford tough with husky frame, Twin-Traction Beam suspension. Optional auto-lock hubs when engaged can shift 2WD to 4WD while moving.

V-6 engine standard, a V-6 with power S-10 Blazer can't match. And Bronco II turns in less space than S-10. The perfect size for 4-wheeling!





# CAR CARE GUIDE

## HOW TO STOP RUST

(Continued from page 125)

the rustproofing. The kind of rustproofing we used comes in two forms: spray-on and brush-on. It's called Car 'N Farm (see Sources for address) and it was specifically made for at-home application. We chose it because it comes in large, economical containers.

The spray-on variety is available in aerosol bottles with 19 inches of tubing and a four-direction nozzle. The brush-on comes in quart and gallon sizes.

For large, flat areas the brush application is best. The aerosol is made for squirting inside inaccessible body cavities, such as the inside of rocker panels. To use the spray, drill a hole in the metal and insert the tubing as far as it will go. Press the discharge nozzle and slowly draw the tube out of the hole. The four-direction nozzle will cover a 360° area.

The number of holes you'll have to drill will depend on the length of the panel you need to fill. Keep in mind that the hole you drilled is now nice and raw and is subject to rusting. To prevent that, use a small brush and red primer to coat the raw metal hole, then coat the primer with a generous dollop of the brush-on rustproofing. Once that's done, get some rubber plugs, at a local auto parts store or directly from Car 'N Farm, and plug the hole.

Bear in mind that this rustproofing material will never dry completely. It does its job by staying moist, repelling water and sticking to the surface onto which it's applied. Therefore, it isn't a good idea to use the rustproofing material in some areas, like the trunk or the engine side of the fenders.

### Inside the doors

At the bottom of every door you'll find several holes stamped or drilled into the metal. These are drain holes, and they allow any water that got past the window weatherstripping to drain out. Many times these holes will be clogged. This allows water to puddle up at the bottom of the doors and rust will form. One reason the holes get clogged is that they are usually too small to do much good. We've had good luck by drilling out the hole by 25 percent and then using a punch slightly larger than the new hole's diameter to punch a bevel to promote better drainage.

As we mentioned earlier, if you see rust down there, wire-brush it off, apply red metal primer and top it off with liberal amounts of rustproofing. Make sure you pay special attention to coating that fresh hole you drilled in the

metal. But be careful not to plug the hole with the rustproofing material.

If you decide to turn the job over to a professional rustproofing, there are a few things to keep in mind.

The first thing you should do is ask for a copy of the guarantee. Read it carefully. Many rustproofers will only guarantee their work if you return the car to them once a year, at a specific date, for a touchup rustproofing job. Some will charge you for this touchup, others won't. They will also stipulate that if the car isn't brought in at a specific date, your guarantee will be void. Make sure that the guarantee gives

you sufficient leeway on the touchup.

Guarantees will invariably state that you'll get your money back if the car rusts. Not good enough. The \$150 back on a rust-out that costs \$400 to fix won't do you much good. Make sure the guarantee states that the rustproofing will fix or replace any body panels damaged by rust at no charge. If a rustproofing won't make that guarantee, it's not worth your money.

Lastly, don't trust just any old rustproofing. Your best bet is to go with large, national chains. If one local outlet goes out of business, any other outlet must honor the guarantee. **FM**

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**Protection you can rely on.**



# How To Fix A Rusted Trunk

**A**s your car ages, the weatherstripping will deteriorate and allow water to seep through. In the trunk, you usually don't notice the seepage until rust begins to form. Rust in the trunk doesn't always come from seepage. Opening the trunk in the rain or snow will allow water to enter and settle in the shallowest areas. And since most people don't really pay much attention to cleaning out their trunk, that standing water will eventually begin the rust process.

The solution, obviously, is prevention. Make sure the weatherstripping is intact and clean up any water that accumulates in the trunk. If rust has already begun to form, the procedure for removing it is very similar to that for removing rust in fender and rocker panels, except in this case you don't want to spray or brush on the thick brown goop that you put under the fenders.

As with the inner fenders, scrape and wire-brush all the rust off the surface. Get the surface down to bare metal and coat it with the red metal primer. In this case, too much is never enough. Let the primer ooze into all the cavities and let it dry thoroughly.

Once it's dry, apply the top coat. Since the trunk doesn't have to be as visually pleasing as exterior body panels, you don't necessarily have to paint it with an air gun and auto body paint. We got excellent results using a spray can of enamel; or you can use lacquer. For a really super paint job you can use Plasti-Kote (see Sources for address). It's a little more expensive than most over-the-counter spray paints, but worth it.

PM

*A high-quality spray paint will do a good job on the trunk; no need to go to the trouble of a spray gun and auto body paint.*

*One can will do a small trunk. In temperatures below 40° F., warm the can in hot water before starting.*



*Before you apply paint to the trunk of your car, mask off everything you don't want coated. Make certain that the surface that you are painting is dry and free of oil.*



*Water infiltration on this car was a direct result of a small leak in the vehicle's weatherstripping. The water settled in the hollows (above, left) and also directly below the leak on the wheel well (left). After cleaning off the rust, you should apply a metal primer and let it ooze into all of the car's cavities (above).*





*A nonoil-based primer gives protective coating and a good base for the top coat applied later. For a super finish, use a sandable primer.*

**T**he battery tray is probably one of the most abused metal pieces of any car. Not only is it subject to the same corrosion as other metal pieces, but it's also subjected to battery acid.

Remove the battery and inspect the tray and the surrounding area. If you find rust, get out the brushes and scraper and go to it. If the tray is beyond restoration, you'll need to get a new one. If the tray is welded to the car, have a body shop cut off the old tray and weld in a new one.

Unlike the inner fender or the trunk we covered in the previous pages, the battery tray and the surrounding inner fender area should be painted with the same type and color paint as the rest of the engine box.

Over-the-counter touch-up spray paint won't do for this job. The best solution is to apply a top coat of quality auto paint.

Professional body shops tackle a job like this with a detail gun. This is like a miniature version of a standard spray gun and needs a supply of compressed air to shoot the paint.

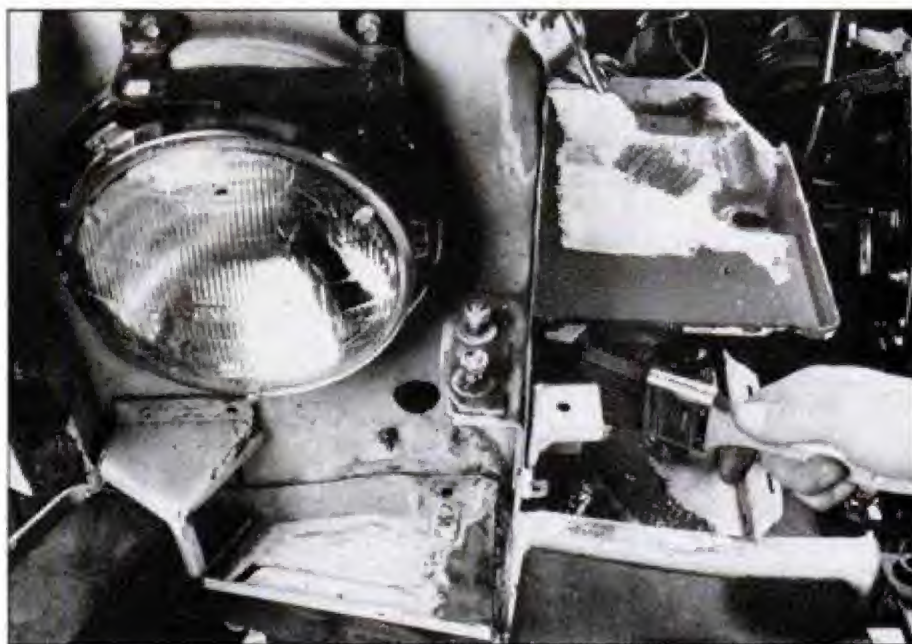
You can get everything you need from a tool rental outfit, but if you plan on detailing the rest of the engine box or need to use small-scale spray equipment, the Stewart-Warner detail gun Model 7821 is a good bet. It's fairly cheap (\$100), light and has all the fine adjustments of full-sized spray guns.

Before you use it on a car, test the pattern and paint density on a piece of scrap metal or cardboard.

Whenever you use any kind of spray-paint equipment, wear a respirator.

Before installing the battery, check the hold-downs and make sure they're in good shape. If they're rusted or corroded, clean them and paint them with the gun.

If the battery tray has a solid floor you might want to drill some holes in the bottom to drain away any water that might accumulate. If you want, you can install a rubber mat in the bottom of the tray. Use ribbed rubber for drainage. The mat also acts as a bumper between the battery and the metal. **PM**



## How To Repair A Rusted Battery Tray



*Rust and battery acid made a mess of this battery tray and area around it. Dismantle as much as you can before scaling.*



*A wire brush used on power drill makes quick work of removing the rust. Wipe off any dust and degrease before painting.*



*A detail gun can be zeroed in to cover particularly small areas (left). Mask off the sections that you don't want painted. When the paint dries, install a rubber mat (above) to isolate the battery.*



# Restoring Rusted Headlight Buckets

**H**eadlight buckets take a beating. They get to the salt spray, road grime and flying pebbles first.

To restore the buckets, dismantle the entire headlight assembly. Start at the exterior and remove the headlight bezel. Bezels are usually held in place by Phillips-head screws. Next remove the retaining screws and disconnect the tension springs that hold the headlamp in place for aiming.

If you haven't done any service on the assembly for a long time you'll find that the screws have rusted in place and are frozen. These Phillips-head screws are easily stripped if frozen so if you can't easily remove them, spray or brush on some penetrating fluid. We used Silikroil, a silicone-based fluid made by Kano Laboratories (see Sources for address). It's not expensive, but it's hard to find in local stores.

Scrape and wire-brush the bucket inside and out. Paint it with two coats of primer and give it a top coat. Plasti-Kote is good for a finish coat.

Next, inspect the rubber grommet which seals the hole that passes the headlamp wire from the harness. The hole for the wire should be just small enough to pass the wire through it. If the hole is enlarged or ripped, as it usually is, you can replace the grommet or repair it with Silastic 732 RTV Adhesive/Sealant or 3M Silicone Super Sealant. Both are room-temperature-vulcanizing rubber which dries to a tough, rubbery solid. It's available from Ain Plastics (see Sources). Before you reinstall the grommet, coat its mating surface and the bucket with this sealant.

Next, check the springs for tension, check the rubber gasket and repair with sealant if it needs it.

If the screwheads are stripped, replace the screws with grade-8 hex-head or socket-head screws. **PM**



*If a headlight bucket is left to rot away, it will not only be expensive to replace, but will also wind up posing a safety hazard. It's wisest to take the time to dismantle the entire assembly and carefully inspect the parts.*

*Clamp the bucket in a vise and remove all rust with wire brush.*



*After cleaning and degreasing, lay all of the parts flat. Spray on a couple of coats of primer and finish coat.*



*Reassemble the parts and apply bead of silicone sealant to the rubber gaskets and grommet at the rear of the bucket. Before installing the lamp, check the plug. If it shows corrosion, brush it off with soft-bristled wire brush. Replace screws if they're rusted or stripped*



## How To Fix A Rust Hole



**O**ne of the easiest ways we found to fix a rust hole is with a dimple-making tool. It's a simple, C-clamp-based device, patented and available only from West River Industries (see Sources). The dimple-making tool allows the first-time body worker to make a really professional-looking repair.

The first step in the repair process is to cut away the jagged ends of the rust hole. Then make dimples 2 inches apart and 1 inch in from the edge of the hole by using the dimple-making device. Center-punch and drill  $\frac{3}{32}$ -in. holes into the center of the dimples. The holes must be centered so the screws will be flush with the metal.

Make a tape handle on an appropriately sized piece of galvanized furnace ductwork and place it in the hole. Hold the metal firmly and mark it through the holes with a felt marker. Remove the metal and drill  $\frac{3}{32}$ -in. holes into the marks. Don't remove the tape handle.

Put the metal patch back in the hole and fasten it with No. 6 panhead Type A sheet-metal screws. As you tighten the screws, the patch will be drawn toward the body. When you've finished attaching the screws, use a straight-edge to make sure none of the screw-heads protrude above the sheet metal.

Next, apply body filler, sand it down to the body surface, primer and paint. We'll cover the specifics of that operation when we talk about body panels in the following section. **PM**



*Make dimples around the perimeter of the hole with tool. Space them 2 inches apart and an inch in from the edge.*



*Drill  $\frac{3}{32}$ -in. holes into the center of the dimples. Make sure holes are centered or screws won't be flush with the metal.*



*Insert the metal patch and mark it for the holes with a felt marker. Hold the patch steady while you're doing this.*



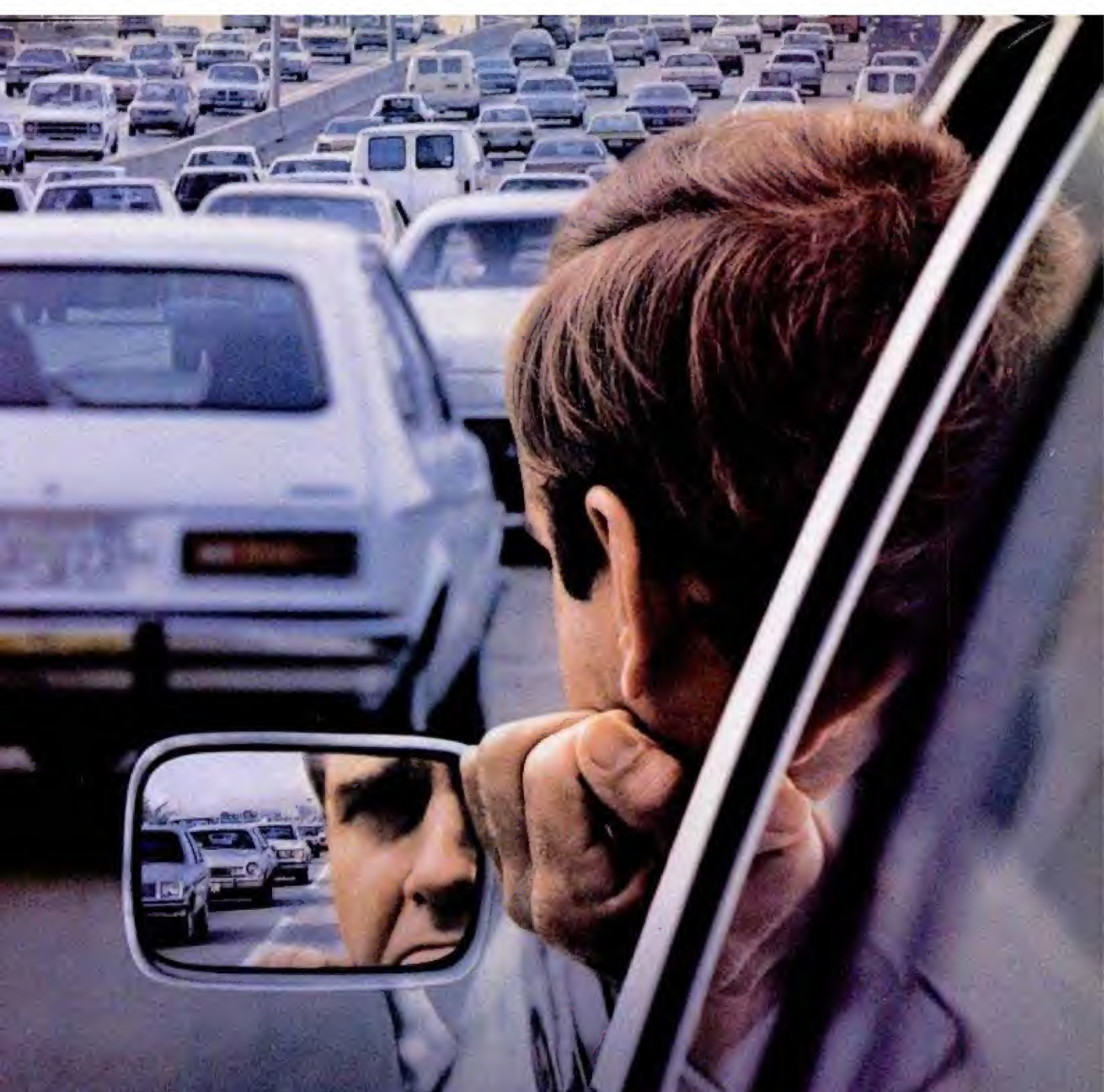
*Drill  $\frac{3}{32}$ -in. holes in the marks. Use a low speed and don't let the drill bit wander on the metal patch. Keep the handle on.*



*Install the sheet-metal screws and make sure that the screw-heads are flush with or below the level of the body panel. Use a straightedge to check for this. Cover the hole with body filler, then sand the spot and prime and paint the repair.*







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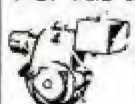
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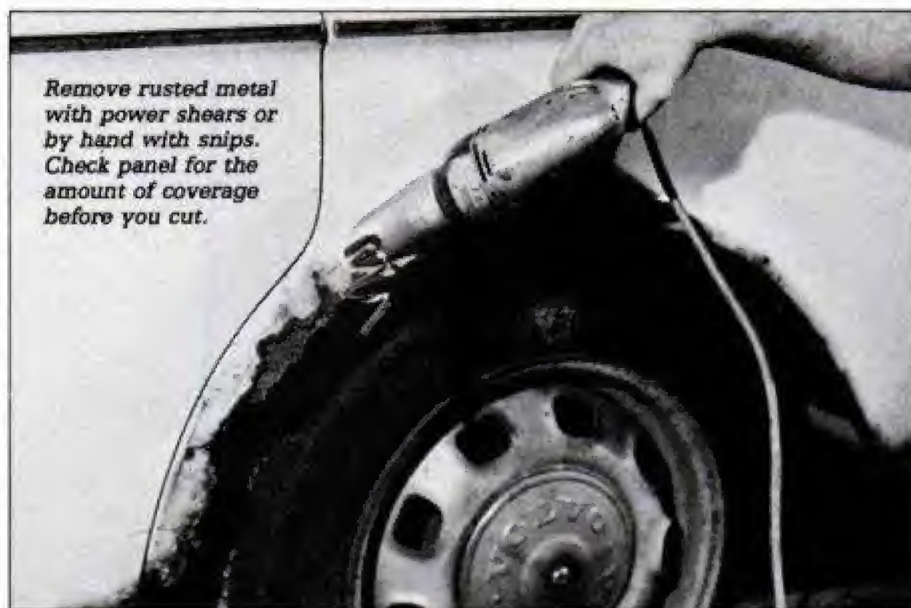
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# '83 CAR CARE GUIDE

**BODY**

## How To Replace A Rusted Body Panel

Remove rusted metal with power shears or by hand with snips. Check panel for the amount of coverage before you cut.



**R**eplacing a large body panel such as a rusted fender arch is a challenging job. The tools needed aren't found in everybody's toolbox, so if you do have an adventurous, how-to spirit, you'll have to rent them.

The indispensable tools are a gas welding rig with bronze brazing rods; power circular grinder; riveting tool and rivets; a picking hammer; two locking pliers; 24-, 100- and 220-grit sanding paper; body filler; glazing putty; and primer. This covers it for actually doing the patch on the fender. If you want to try your hand at painting it as well, you'll need a spray gun, paint and an air compressor.

If you've got the kind of damage pictured on all four fenders, it may be worthwhile to rent the tools and try it yourself. If it's just one fender, it might be more economical to turn the job over to a pro.

The first step is to determine the extent of rust damage and find a replacement panel to patch it. Tabco is virtually the only firm around that will  
*(Please turn to page 137)*

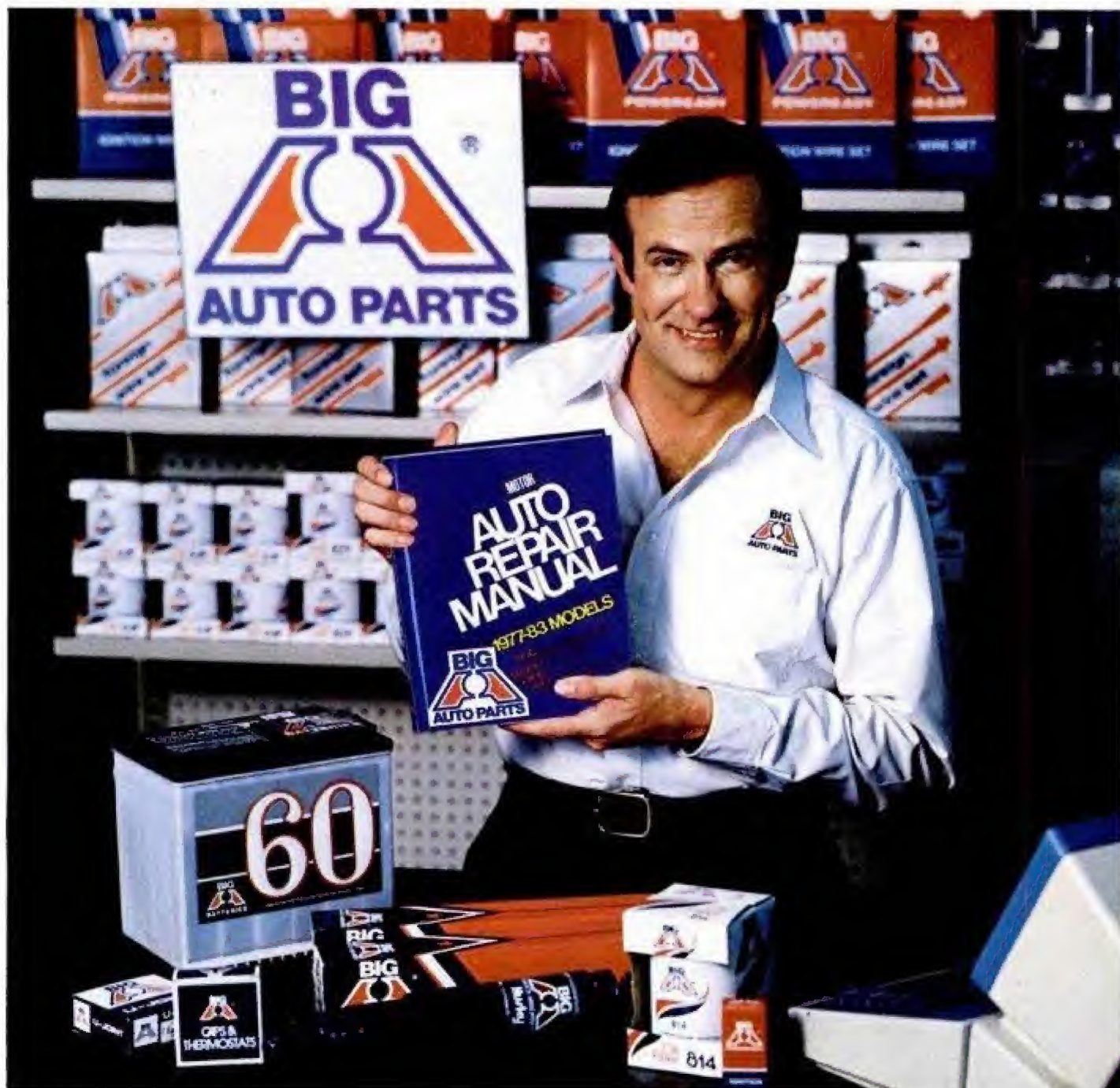


With 24-grit paper on a power grinder, remove all the paint around the rust. Grind until you expose bare metal.



Attach the replacement panel on the car with locking pliers. Make sure it aligns before you drill and rivet.





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A group of five men are celebrating at a bar. In the center, a man in a red polo shirt is sitting on the bar, holding a large trophy and a glass of whiskey, shouting with joy. Behind him, another man in a red shirt is also shouting and holding a glass. To the left, a man in a white shirt and tie is smiling, with a bottle of Kessler whiskey on the bar in front of him. To the right, a man in a red shirt is shouting and holding a glass. In the background, another man in a red shirt is cheering. The bar has a dark wooden surface with a glass of beer and a glass of whiskey on it.

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ship you replacement panels that you select from their catalog (see Sources). Hold the panel over the rusted area and determine how much of the existing panel you'll need to cut away. A power nibbler makes short work of this, but metalworking snips will do as good a job.

Attach a 24-grit paper to the power grinder and grind off all the paint along the perimeter of the rusted area. Make sure you expose bare metal. Put the replacement panel over the damaged area and secure it in place with locking pliers. Make sure you've got a flush fit all around with proper alignment in the



*If the replacement panel is aligned properly, drill holes every 4 in. around the perimeter and install the rivets.*

front and rear at the bottom of the bodywork.

Drill holes along the entire perimeter of the panel. The hole size is determined by the length of the rivet you'll have to install to hold the panel to the body. Holes should be drilled about 4 in. apart and 1/2 in. from the edge of the panel. Install the rivets. If the panel is properly aligned, the rivets will force the panel flush to the body.

Once the rivets are installed, you're ready to braze the panel in place. Brazing is just like welding except you use much lower heat, to prevent metal stretch and buckling, and you use a bronze rod. If you've never done this before, practice on scrap pieces first.

Don't braze the entire perimeter at once. Place a few spot welds at either end of the panel and two in the center. Once the panel is tacked in four spots, begin at the front and weld a line about 6 in. Stop and go to the other end and do the same, gradually working your way toward the middle. Don't hold the flame in any one area for too long. This will cause the metal to warp.

With a new piece of 24-grit in the grinder, grind away all paint for an area 6 in. up from the panel and grind the weld bead smooth.

Body filler is a two-part material—



*Braze the replacement panel in place with a gas welder and a bronze rod. Don't hold flame on one spot for too long or the metal may become warped.*



*With a picking hammer, gently bang down high spots and remove any slag (above, left). Grind down high spots on weld bead (above) and remove rest of paint from around panel. Mix body filler and apply thin, even layers (left).*



*With a power sander or a hand sanding block, sand down the body filler. The edges of the filler should be very, very thin and blend almost inconspicuously with paint at the border.*



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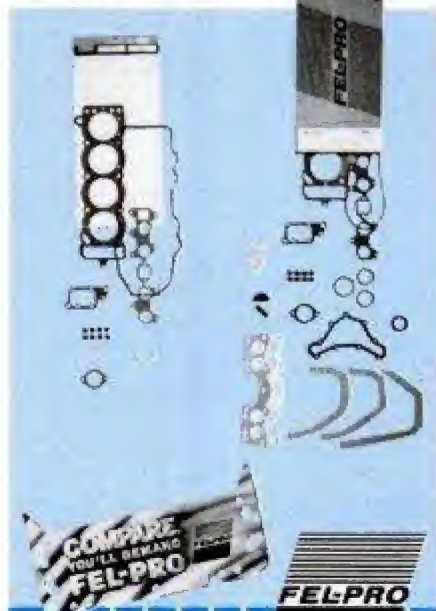
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# CAR CARE GUIDE

**BODY**



*Sanding the filler is critical. You're sculpting contours of the bodywork. Feather- edging in some spots is so thin it shows bare metal beneath.*

*Mask everything that doesn't get painted and spray primer on patch. When dry, apply glazing putty, wet sand and paint.*



the filler and a hardener, usually of different colors. Mix the two according to the directions. Apply the body filler in thin, even coats. The filler will begin to harden within 15 minutes, so work quickly.

With 100-grit paper, power sand or hand sand the filler, removing all the ridges and contouring the filler to match the original contours of the car's body. At the border where the filler meets the paint, you'll have to feather-

edge the filler, reaching the point where you can't feel the difference in buildup between the filler and the paint with your fingers.

Prime the panel, apply the glazing putty that comes with the body filler and wet sand the putty with 220-grit paper. Hold a sponge above the paper and let a stream of water wash over the paper as you sand. Let the panel dry, clean off dust and spray paint patch with matching paint. **PM**



*When the repair job is finished, the body panel should look like the original work. Note that the new paint on the panel has been blended with the original finish.*





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# CAR CARE GUIDE

**BODY**

## How To Install An Antichip Strip



Look what happens to the area behind the wheels (left) after years of road abuse. To protect this area, install plastic antichip strip. Tape the strip to the area and trace the outline with a washable marker (below). Spray a solution of water, alcohol and a drop of detergent onto the area. Peel off the backing paper and apply the plastic film.

**P**aint chipping on rocker panels and doors caused by road debris and flying stones can be a problem. If your car didn't come with rubber molding along the bottom use a new product called 3M Urethane Film (see Sources).

The adhesive-backed, abrasion-resistant film is thick, pliable and nearly invisible. It can be painted or left as is. Tape the film and its paper backing to the body. With a washable felt marker, trace the outline of the area you're covering on the film. Remove the film and cut out your pattern. Fill a window-washing spray bottle with a solution of 75 percent water and 25 percent isopropyl alcohol. 3M recommends that you add one drop of dishwashing detergent to make the installation easier. Wet the area, peel off 2 or 3 in. of film from paper backing and attach to the body. Slowly pull backing off. **FM**



Once the film is on, position it where you want it and squeeze out the water and any air bubbles with a hard rubber squeegee. When installed, the plastic is virtually invisible. It will take years of wear before you have to replace the film.



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EXCEEDS THE NEED

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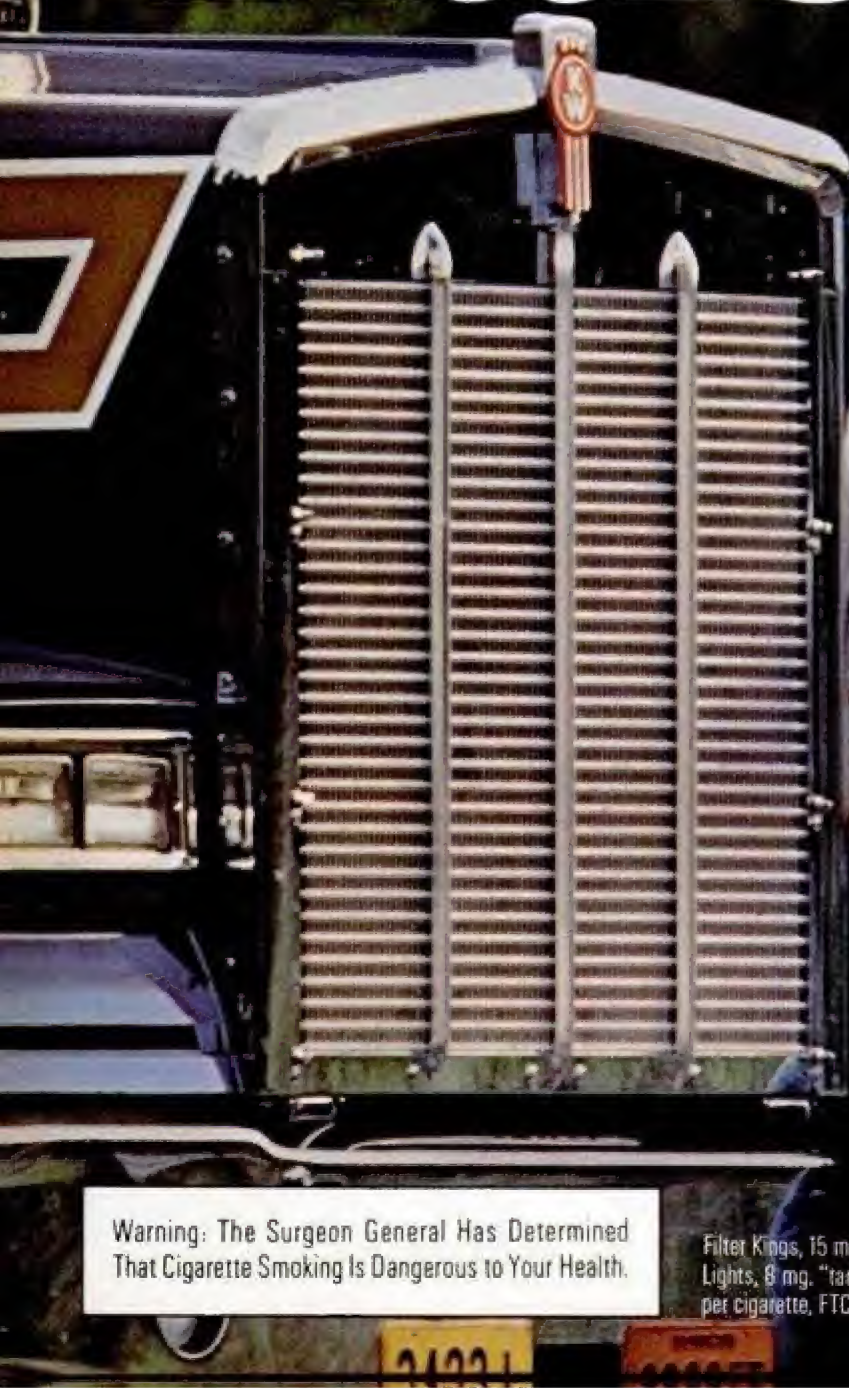
from their electrodes. Thus allowing a cleaner path for the spark to ignite precious fuel mixtures. That means less wasted gasoline in any properly tuned normally driven automobile—no matter how advanced. Motorcraft Extended Tip Spark Plugs. Engineered to eliminate fuel-thieving sooty carbon, without eliminating themselves in the process. Motorcraft. Quality parts for all makes of cars. *Get it together—buckle up.*





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# Raleigh



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## Waterproofing Turn Signals And Brake Lights

**T**urn signals and brake lights are particularly prone to water infiltration and corrosion. Considering their location, it's no surprise. We're sure everyone has seen or experienced taillights flooded with water.

The cure to these problems isn't difficult or expensive. Installation and removal methods and materials vary from car to car, but the following is representative of some of the problems and solutions.

Inspect all the turn signals by removing and disassembling them. Fastening methods are usually Phillips-head screws driven into sheet metal or plastic molding.

Inspect the gasket for corrosion and cuts. If these are defective they can be repaired with Silastic (see *Restoring Rusted Headlight Buckets*). Check the housing, which contains the lamp socket, and look for rust or corrosion. The interior of the housing is usually bright plastic or metal. In either case, restore them if they're intact but dirty.

With a small drill and wire brush (we used a Dremel tool), remove rust and scale from the housing and the lamp socket. Make sure you don't remove too much metal from the socket or the bulb won't sit tightly in the socket.

Metal can be made to shine again by carefully using a wire brush. Bright plastic with the metallic shine gone can't be made to shine again. But you can glue some aluminum foil to the back of the housings.

If the gaskets are leaking, they need some help. Apply Silastic at the mating surfaces of the gaskets and the lens and the housings. Assemble the parts and let the Silastic dry. It usually takes 24 hours at room temperature to cure fully. After it's dried, disassemble the unit and check to see that you haven't left any gaps or voids. When the Silastic is fully cured, it will act as a gasket within a gasket and make the unit invulnerable to water seepage.

When you install the bulb, squirt some light lubricant like WD-40 into the socket. This will prevent further oxidization of the metal.

At the back of the assembly, where



Water penetration has nearly ruined this turn signal. Repair the damage by removing the rust. A small power tool works well (far left). To prevent further penetration, apply a bead of silicone sealant around the rubber gasket (left).



Heat-shrink tubing is used to close off the hole at the back of the rubber boot. You should use a heat gun, not a match.



To ensure watertight fit, add a bead of silicone sealant to the back of housing at the mating surface of the gasket.

Bright plastic can't be repaired, but you can paint it black with a good-quality spray paint. Sand off the residual bright plastic and then mask the assembly.





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## BODY



Flat or semigloss black will give the best appearance. Let the paint dry between coats and apply two coats to the trim.



If the surface has been sanded and prepared properly, the final result should be a flat, even coat of paint.

the wire enters, you'll usually find a rubber boot or a grommet.

Boots are usually molded with a tiny nipple through which the wire passes. To protect this entry from water, cut off a 2-in. section of TAT heat-shrinking tubing (see *How To Solder-Splice And Use Heat-Shrink Tubing*) and make certain that the tubing overlaps the nipples.

Some older cars, before the advent of Euro blackout trim, came equipped with exterior bright plastic bezels and surrounds. With time, the bright plastic wore off due to the sandblasting effect of road grime and pebbles. Instead of replacing the entire unit with a new one, you should consider painting it flat black.

Mask off the area with tape and, using a very fine grit sandpaper, such as 200, sand off the remaining bright plastic. Get it down to the natural plastic, blow off the grit and paint. **PM**



To prevent further oxidation inside lens housing, apply thin, even coat of lightweight oil. Wipe off the excess.



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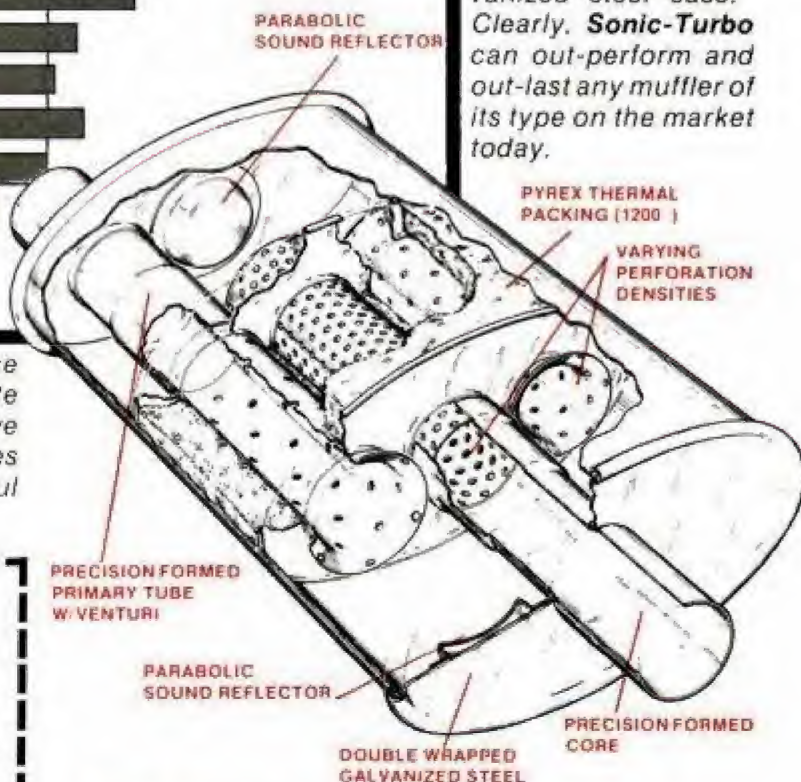
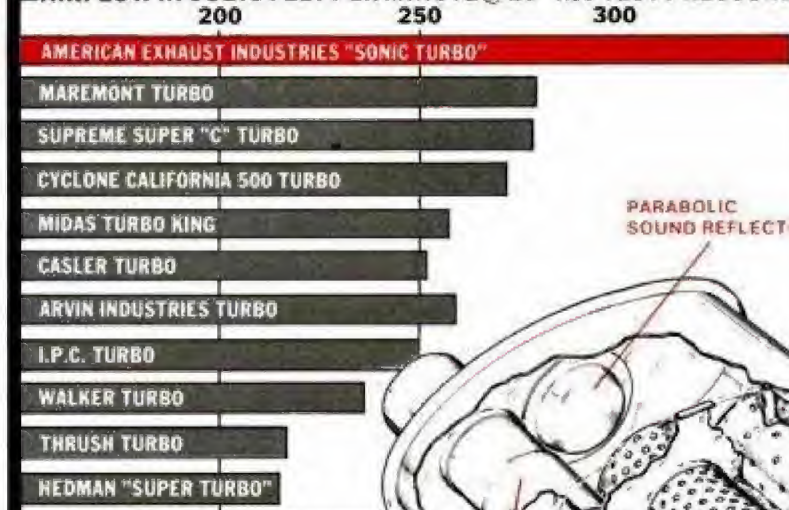
You should also know that this extra performance is not gained at the expense of increased noise. Quite the contrary. Because of **Sonic-Turbo's** exclusive "Parabolic Sound Reflectors" offensive sound waves are cancelled out. All that remains is a deep, powerful

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# Rustproofing Accessory Brackets



## SMALL ENGINES WORK HARDER THAN LARGER ONES

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All this means more wear and tear on your smaller 4 cylinder engine. It needs more care and attention. A quart of RISLONE with each oil and filter change will help get rid of those deposits that rob your engine's efficiency and smoothness. Clean engines run better, longer and more economically than dirty ones.

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*Different brackets will require different types of protection. The one exposed to the most severe abuse should be chrome plated. The rest can be painted or encapsulated in plastic.*

**A**ccessory brackets in the engine box are as prone to rusting and deterioration as any exterior body panel. The three solutions that we've found work the best are painting with a high-quality paint, encapsulating in a thick plastic material and chroming.

Before painting any bracket, wire-brush it to bare metal, apply a coat of primer and two finish coats.

Coating with Plasti-Dip (See PDI in Sources) is a little trickier. Wire brush the bracket and degrease it. Then, very slowly dip the part in the can. If you dip it or remove it too quickly, air bubbles will form and you'll have to do it over. If ambient temperature is below 60°F., the plastic will get lumpy. You'll need to heat it in a pan of warm water. If it's too lumpy from being on a shelf too long, thin it with mineral spirits.

Chroming is the best, but most expensive, solution. Save that for parts that have to live near very hot engine pieces. Local chrome shops are often reluctant to do small jobs, but an excellent mail-order plating service exists (see Brown's Plating Service in Sources). Send them your pieces and they'll send you a written estimate of the job and expected delivery date. You can then okay the job.

If you find a local chrome shop, make sure you specify triple chrome plating. In this process, the metal is first hand-polished, then a layer of base metal is plated, it is polished again, another layer of base metal is plated, then polished again and finally chrome plated. **PM**



*A bench grinder with a wire wheel will quickly get to bare metal. When spray painting (below), apply thin coats.*



*Dip clean, grease-free brackets slowly into can of plastic. Let metal soak in the solution. If the plastic is too thick, warm it or thin it with mineral spirits.*



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\*Height of combined units over 3 feet: 37 1/2 inches.

\*Four steel ball bearing swivel casters...smooth-rolling, solid rubber wheels.

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# How To Soundproof Your Car

**T**he letters we get about noisy cars indicate that the biggest problem is how to prevent noise intrusion from big body panels like hoods, doors, trunk lids and side panels.

Today's newer cars have little, if any, soundproofing in the doors, hood and trunk lids. In an effort to save weight and money, sound insulation packages are reserved for the options list. In the case of low-priced, super-economy cars, soundproofing isn't even an option.

One workable solution we found is the installation of dense foam rubber. This is the type of foam that lines camera and electronic equipment cases. It has a curvy, hills-and-valleys configuration and comes in a variety of sheet sizes. The foam sheets come in double layers, with the hills and valleys interlocking. A 4×8-ft. double sheet cost us \$21. That comes to 64 sq. ft., enough to do two entire minicars or one full-size four-door sedan.

You don't have to remove the hood to install the foam. We removed it only to make our photography easier.

Foam thickness varies and you'll have to determine the clearance between the hood and the highest point of the mechanicals in the engine box. You can do this by attaching a lump of clay to the highest point on the engine and closing the hood. The clay will be mashed down to the thickness of the foam you need to use.

Your foam supplier will give you a spec sheet on the foam you buy if you ask for it. We used foam that resists temperatures up to 220° F. Your foam should resist heat at least that well.

Clean the inside of the hood with a degreaser such as Trichloroethane 1,1,1. Remove any rust or acid deposits that might have gotten on the hood from the battery. Prime the area if you scrape. If you're really fussy about appearance, you can repaint the inside of the hood with body color paint. We only had rust on the welded-on stiffening ribs, so we scraped it and didn't repaint the primer.

Cut the foam to the approximate shape of the area to be covered. Then apply liberal amounts of 3M Super Sili-



Dense foam rubber sheets that are glued to the bulkheads in your car will cut down on the noise level of the vehicle. The foam should resist heat up to at least 220° F. You may find it necessary to reroute speaker or harness wires.



Apply glue to the foam as well as to car's metal surfaces. Let the glue get tacky before installing the foam sheet.



In areas hidden by trim panels, expanding foam urethane provides temperature and sound insulation. Use it sparingly.



Test-fit the foam panels and operate the lock mechanisms and window winders before the final gluing. Make sure the foam doesn't interfere with any of these.



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# '83 CAR CARE GUIDE

**BODY**



*Before installing foam under the hood (left), check for clearance with engine parts. Foam shouldn't come in contact with engine pieces. To prepare the surface for adhesive, degrease or paint as necessary. Because of rust and acid deposits on the stiffening ribs (below), this hood needed repainting. The masked-off area, however, was still in good condition.*

cone Adhesive/Sealant to the metal and the foam. Wait a few minutes before bonding the foam. This lets the adhesive get slightly tacky.

After the glue has dried, use a razor to finish cutting the foam. If you have engine timing or emissions specifications labels glued to the hood, you can either try to remove them and transfer them to an inner fender, or do as we did, leave a hole in the foam to keep the specs visible.

You can apply the same techniques for soundproofing the trunk lid and the trunk wall. The inside of door and body panels can also be soundproofed.

When you're working with a door you need to be more careful and precise than with a hood. Make sure the foam won't interfere with lock and window-winding mechanisms.

Don't install the foam right to the bottom of the door. Leave a gap of an inch to two. If there is leakage in the future, this will allow water to drain out of the drain holes.

In rear panels with fixed glass, you can use the foam sheets coupled with Geocel Expanding Foam Sealant. This sealant comes in 12-oz. bottles; won't give off any toxic fumes, which is important in a closed car; and is fire resistant up to 250° F. One inch has an R value of 5.

Don't be overenthusiastic using the Geocel. Not only does it expand as it comes out of the spray can, but it expands as it cures, a process that takes several hours. If you've applied too much of the foam sealant, wait until it cures and trim the excess.

Geocel foam sealant is available locally in hardware and home improvement centers or directly from Geocel or from Ain Plastics (see Sources). **PM**



*Rough-cut the foam sections and test-fit. Apply the adhesive, install, and trim the foam after the adhesive has dried.*



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**How Do I Prevent It From Happening to Me?** A small investment now in a Hayden oil cooler can double the life of your car's transmission and engine. Remember, every 20°F drop in oil tem-

perature doubles oil and equipment life. Transmissions repairs run \$400 to \$1200.

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\*Courtesy ATRA (Automatic Transmission Rebuilders Association).

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# How To Solder-Splice And Use Heat-Shrink Tubing

**A**ccording to the letters we receive addressed to *Car Clinic* and the phone calls we get every day, electrical problems seem to be the most aggravating kind of all to fix. Oil leaks, fouled plugs and rust are easy to spot and fix, but "invisible" electricity still stumps a lot of people.

The following section will not cure all your electrical problems, but it will go a long way toward assuring you that your wires, grounds, contacts and connectors are giving the juice a clear, unobstructed path.

First the good news. Technological fallout from the aerospace industry has had a beneficial impact on cars. Aerodynamics, plastic composites, lightweight metals and computer-aided design and analysis have found their way into cars already in your driveway. But Solder-Sleeve splices and TAT (Thermofit Adhesive Tubing) are not yet used. We're the first to show you how to use these new wonders.

The bad news is that you can't find them at your local hardware store or your local anything. Up to now the only place you could find them was on the Lunar Lander, the Space Shuttle and the F-16. However, by special arrangement with the manufacturer—and it took some arm-twisting—PM readers can get some of these hyper-technoid goodies by mail. We'll tell you how later. First, let's get to using it.

Solder-Sleeve is the patented trademark of Raychem Corp. for a heat-shrinkable plastic tube which has a small ring of solder. Using it is easy.

Strip the ends of the two wires you need to splice. Grab the appropriately sized Solder-Sleeve connector and insert a wire in each end so they overlap, making sure the solder ring is placed smack in the middle of the overlapping wires. Apply heat from a heat gun and watch it go to work.

The tubing will shrink on either end of the solder ring first. The solder ring will then melt and flow onto the wires, soldering them together.

It takes 125° F. to melt the solder, so a conventional hair dryer won't work. You'll need a heat gun, the kind used in



*High-output heat gun and some special tips are all you'll need. Shown are some that are available from the tubing maker.*



*Solder-Sleeve comes in a variety of sizes that fits any automotive application. To install, strip the wires and insert them into the tube. Make sure the wires overlap and that the solder ring is located in the middle of the overlapped wires.*



*Heat from the gun will shrink the tube (above) and a few seconds later will melt the solder (above, right). It does as good a job as soldering iron, but it's neater. To solder a wire to a connector (right), apply just enough heat to shrink the tube. Then tilt connector downward and apply heat directly to it. The heat will pull the solder into the connector.*





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northAmerican Van Lines offers the opportunity to take control of your future. Run your own business as an owner/operator. Investment required. Complete information kit. Free

## 689 Keeping Diesels Happy

Tips on keeping your diesel car, pickup or van in tip-top running condition. Describes diesel operation and proper fuel and lubrication selection. From Kendall. Free

## 690 Power Of A Personal Computer

Four-color brochure describes the Commodore 64, offering computer power at half the price. Includes descriptions, comparisons and specifications. Plus program information and add-on features. Free

## 691 Knock No More

Brochure from Carter highlights their Engine Knock Eliminator, an automatic knock suppression system that can protect your engine and save you gas dollars. Includes application and installation information. Free

## 692 Auto Electronic Systems Manual

Step-by-step instructions for troubleshooting all the domestic electronic ignition systems and engine controls. It's all in a new 36-page service manual from Fram/Autolite. Plus detailed charts and wiring diagrams. \$2.95

## 693 Dealing With A Clean Deck

Dust, pollutants and other impurities can interfere with your enjoyment of your home entertainment system. Brochure describes cleaning products for records, audio cassette decks and video cassette recorders. From Allsop. Free

## 694 The Cool Solution

9 out of 10 transmission failures are caused by overheating. A brochure from Integrity Transmission Coolers explores the advantages of an automatic transmission cooling pan. Free

## 695 The Reel Fishing Story

The 1983 84-page, full-color catalog from Daiwa features a full line of fishing tackle. Included is the Daiwa Tackle Selector© to help you perfectly match Daiwa rods and reels to the kinds of fish you want to catch. Free

## 696 You Could Be Racing!

The excitement of big-time racing on a mini budget. Information on "Karting" includes engines, parts, history, and associations. Also listing of over 500 tracks and discount prices direct from the original "Bug" Kart factory . . . K & P Mfg. \$3.00

## 697 Down Under

1983 catalog shows a complete line of sportfishing sonar products and hints on how to choose the right equipment. From Lowrance, an industry leader for over 25 years. Free

## 698 Make Your Car A Nicer Place To Drive

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## 699 Power Plus

Test result package from Edelbrock shows how your V8 can come alive with Performer Products. Increase both torque and fuel efficiency. Free

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various construction jobs, to make the Solder-Sleeve work. To solder a wire to a connector, you follow the same procedure, except you apply heat to the connector, not the Solder-Sleeve.

Slip the Solder-Sleeve over the wire, slip the wire into the connector and place the solder ring between the exposed wire and the connector. Heat the Solder-Sleeve just to the point of shrinking the plastic. Then place the connector in front of the heat gun and hold the wire slightly higher than the connector. This will heat the connector, melt the solder and draw the solder into the connector.

In one operation you'll have a soldered connection which is insulated and sealed tight to water, road grime, grease and lubricants. The Solder-Sleeve will remain resistant to impact brittleness down to  $-131^{\circ}\text{F}$ . and fire resistant to  $257^{\circ}\text{F}$ .

Solder-Sleeve, by the way, happens to be the only splicing procedure NASA allows on the Space Shuttle.

Heat-shrink tubing has been around for quite a while, and, like everything else, there's the good stuff and the not so good. Thermofit Adhesive Tubing is the best. Unlike conventional heat-shrink tubing, TAT has an adhesive coating on the inside. When the tube is heated and shrunk, the adhesive melts over the wire's insulation and cools to a semirigid state. This gives whatever it's covering environmental protection as well as mechanical strain-relief. In other words, if you were to pull on the wire, you'd be applying stress to the insulation and the heat-shrink, not directly to the electrical connection.

This tubing is designed for continuous use in temperatures ranging from  $-67^{\circ}\text{F}$ . to  $230^{\circ}\text{F}$ . At  $250^{\circ}\text{F}$ . it will begin to soften up a bit and the adhesive will begin to flow. However, it would take a direct flame to get it to deteriorate. And even then the material will vaporize rather than melt and burn like conventional PVC (Polyvinyl Chloride) heat shrink. Furthermore, PVC tubing will release toxic gases, which you don't want in case of a fire in your dashboard.

The material in TAT is a selectively cross-linked, dual-wall Polyolefin. On the molecular level this looks like a suspension bridge, with the horizontal cables and roadway selectively linked to vertical cables. The vertical cross-links are what give this tubing its durable qualities.

Using TAT is even easier than using the Solder-Sleeve splices. Cut it to size, slip it over whatever you want to pro-



*The recommended method for insulating a Y-type connection is to use the heat gun to shrink two legs of the Y, which have been fitted with the appropriately sized tubing.*



*Slip a third piece over the "trunk" and overlap the two previous pieces of tubing by at least  $\frac{1}{4}$  in. Apply heat.*



*While the tubing is still soft from heat, spread the legs and crimp the tubing in the middle with needle-nose pliers.*

tect, and apply heat from the heat gun. Since it shrinks to half its size, use a size twice as large as the wire or wires you need to protect.

If you need to protect a Y-type of splice or connection, you can do it in three steps (see the photos above).



*Hold the needle-nose pliers to the tubing until the adhesive has cooled and dried.*

The only possible disadvantage to using heat-shrink tubing is the need to cut it apart to get to the middle of a bundle of wires. However, the other side of the coin is the fact that the need to get to a failed wire will probably be eliminated simply because you've insulated it with the tubing. The probability of a failure will be almost zero.

If you ever do need to get to wires, you can remove just a section of heat-shrink tubing and simply slip on another length to make a patch.

As we mentioned earlier, Raychem will make these products available to PM readers. Write to Raychem Corp., Devices Div., 300 Constitution Drive, Menlo Park, Calif. 94025, Attn.: Popular Mechanics Car Care Guide.

They'll send you free of charge a complete product description, specifications sheet, prices and ordering instructions.

**PM**



Warning: The Surgeon General Has Determined  
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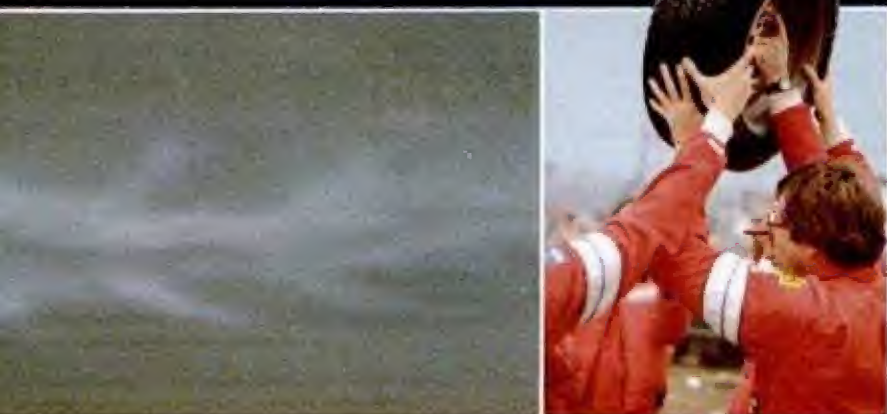
# from Firestone.

Talk about making history fast. Fresh out of the chute, in its American debut and first race ever, Firestone's European designed and produced S-660 radial did what no other street tire has ever done before. Grab the checkered flag in a major pro class at the 24 Hours of Daytona. The toughest Daytona ever, as torrential rains red flagged the race for the first time in its 21 years, and as over 60% of the field packed it in along the way.

But wet or dry, the S-660, modified only by shaving to racing depth, ran like a champ all the way. Speeds over 160 mph, over 2,000 total miles,

with no tire failures of any kind—making it a number one finish in class and 12th overall for Dave Kent's RX7 Mazda and the racing team of Lee Mueller, Terry Visger, and Hugh McDonough. And leaving a lot of tires built just for racing behind. That's real proof of performance from a tire you can buy.

The S-660. European H-speed rated. More fire from Firestone. Check it out at your Firestone retailer along with Firestone's full line of specialty and performance tires. At Firestone, we build radials competition tough. And the proof is in performance.



## Firestone

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## Protecting A Wiper Motor

**E**lectro-mechanical components like a wiper motor are subject to the mechanical wear of the moving parts as well contamination on contacts that can cripple the component. The following is a guide to what can be done to protect power windows, power seats, wiper motors, pop-up headlight mechanisms and other power components.

First, inspect the entire mechanism for wear and contamination. Clean off all dirt with a degreaser or Electric-Motor Kleen (see CRC in Sources) if the motor needs tidying up. If wires are cracking or brittle, remove them and replace them with fresh wires of the same gauge. In our case, we found the lack of a gasket in the motor housing allowed grime to enter the motor. We made a gasket using 3M pliable gasket material.

Lubricate all the moving parts with lithium grease or a wet Teflon lubricant (Ain Plastics). Teflon is neater than grease and doesn't attract dirt as easily. Uninsulated, exposed electrical connections can be potted with Flexane room-temperature-curing urethane. Depending on the ratio of hardener to resin, it will cure to a durometer hardness between 74 to 90. For this application, softer durometer hardness is better.

When you reassemble the unit, apply a locking compound (Loctite) to all fasteners. This will prevent their backing out. Clean and resolder connectors if necessary and protect the wiring bundle with heat-shrink tubing. **PM**



*This wiper motor assembly was headed for imminent failure. It was suffering from grime, corroded electrical connectors and loss of lubricant in the moving parts.*



*Old, corroded electrical wires should be removed and new wires of the correct gauge should be soldered back in place.*



*This electric motor housing didn't have a gasket. The poor seal let in dirt. A gasket was made with gasket material.*



*Corroded spade lugs in connector should be cleaned with wire brush. If it is necessary, resolder the wires.*



*Mix only enough urethane for job at hand. Read instructions carefully so that you mix the proper ratio of catalyst.*



*Dip exposed electrical connections in urethane, then let it dry completely before handling the assembly.*



*Use a locking compound on fasteners when reassembling unit. Vibration can cause fasteners to work loose.*



# How To Install Silicone Sparkplug Wires

**B**ecause of their location, the amount of heat they must tolerate and the work they do, sparkplug wires are subject to a lot of deterioration. They lose their effectiveness, but that's not visible. They look alright, but they could be arcing or not providing a strong enough spark to do the job. Your first indication of this is a loss of performance and an increase in fuel consumption.

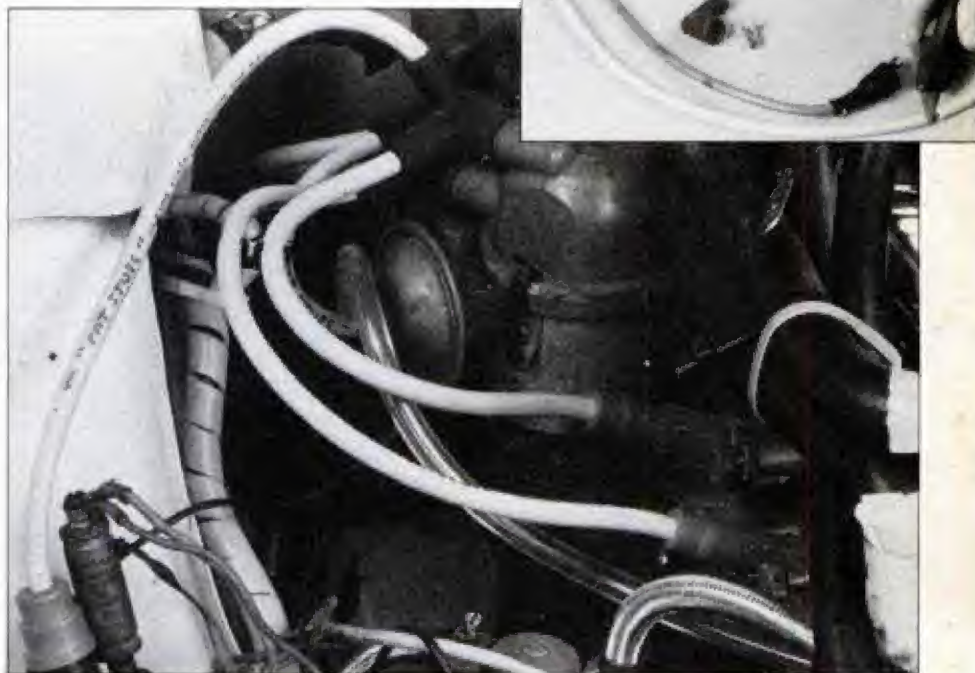
Silicone-insulated sparkplug wires are superior to conventional wires because they resist heat and cold better and remain pliable and brittle-free at these temperature extremes. They last two to three times longer than conventional wires.

Installing a set of silicone wires is no harder than installing conventional plug wires. In most cases, you can buy ready-made sets for your car. If not, you can cut them to size by buying a bulk roll with enough boots and tips.

The most delicate operation is removing the insulation, while not cutting any of the wire strands. To do a good job, make a few practice cuts before attempting to do the entire set. Remove only one old plug wire one at a time and use it as a guide for cutting the silicone wire to the correct length.

Cut off a half inch of insulation and bend the wire back over the insulation. Then slide the terminal connector over the bent back wire and crimp the connector gently with a pliers. Don't crimp it completely with the pliers. With your set is a crimping tool made specifically for this job. Clamp the lower end of the tool into a vise, place the wire and connector in the tool and, with the other half of the tool, crimp the connector tightly by hitting gently with a hammer. The crimping part of the connector should crimp tightly around the insulation and the mating surface of the connector should be flush against the bent-back wire.

When ordering a bulk set like this, specify the right boot and connector angle for your car. Check your needs before buying. We used Accel Fat Stuff Silicone wire. Accel is the most available source for this type of wire. **FM**



A silicone sparkplug wire set will last longer than original-equipment sparkplug wires because wires stay pliable and brittle-free at extreme hot and cold temperatures.



With a sharp knife, slice off about a half inch of insulation. Don't cut any strands of wire while trimming.



Bend the wire back over the insulation and gently crimp the connector over the wire with a pair of pliers.



Start by placing the lower half of the crimping tool in a vise and then insert the connector carefully into the tool.



Place the second half of the tool over the connector and tap the crimp in place with a few light blows of a hammer.



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## '83 CAR CARE GUIDE ELECTRICAL

# Protecting Your Coil, Distributor And Wiring Harness



Foam Neoprene boot installed around the coil will keep it dry, and dirt, engine and road grime off it. Note the coil wire is protected with Convolex tubing.



To make a boot, lay the coil on a sheet of foam, cut it to size and install snaps (above). Leave a notch in the boot to clear the coil-mounting bracket.



In the past few years some of the more expensive Japanese cars have been using neoprene boots on the coil and distributor. This is an excellent idea. You can make your own from small sheets of 1/8-in. neoprene (Ain Plastics) and a snap fastener installation kit.

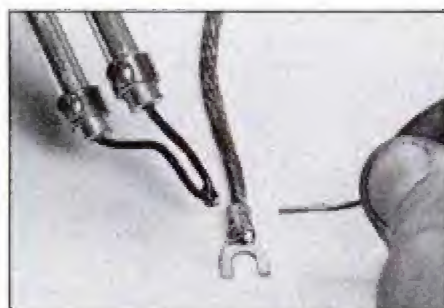
Remove the coil and distributor cap, place them on a sheet of neoprene and cut it to size. You'll need to make relief notches to clear the plug wires (distributor) and mounting bracket on the coil. Sparkplug wires should be sheathed

with Convolex tubing (Raychem). Protect the wiring harness with spiral wrap (Ain Plastics) or Convolex.

Large ground cables for batteries should be mounted with a stainless-steel fastener. Smaller diameter corroded ground wires should be replaced with copper ground straps. These are at most electrical hardware suppliers or motor rebuilders. Custom fabricate them with good-quality lugs (Vaco) and insulate with heat-shrink tubing. **PM**



This battery ground cable is protected with spiral wrap, installed with stainless.



Small ground straps should be of copper, soldered to connector and heat shrunk.



# NOTICE!

## FROM THE MOTOR POOL



### MARINE SURPLUS SALE!



# BRAND NEW CAR, JEEP & TRUCK ACCESSORIES

**(still in original cases) to be offered to the public starting midnight, tonight!**

Starting midnight tonight—Marine Surplus Depot will accept orders directly from the public for the following motor pool parts and accessories, so long as limited supply holds out. Items being released at this time are:

#### STORMPROOF, HEAVY-DUTY CAR, JEEP & TRUCK TARPS

A "Portable Garage"—each is a huge 25' x 12' constructed of heavy-gauge, high-density polyethylene with 8 reinforced grommets to insure tie-down protection from rain, sleet, snow, dust, dirt or salt spray. Guaranteed stormproof, waterproof, rotproof, mildewproof... strong enough to withstand ocean storms... big enough to cover any car, jeep, station wagon, pickup truck or van. Also great to protect boats, motorcycles, machinery, firewood, barbecues and lawn furniture. LIMIT: 3 per address. #101 Only \$8 each.

#### MARINE NIGHT DRIVING GLASSES

Cuts out headlight glare-blinding sun—even lets you drive through fog or snow with night owl vision! Special lenses make dim, hazy objects suddenly appear movie screen clear. A must for every glove compartment. LIMIT: 3 per address.

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#### GIANT (OVER 7 FEET LONG) SHIPS HAMMOCKS

FOR RELAXING—SUN BATHING—OR PLAIN, OLD "BACKYARD SNOOZING" SIMPLY HOOK ONTO TREE... POLE... FENCE... OR SIDE OF HOUSE AND GENTLY SWAY BACK AND FORTH LIKE A BABY ROCKING IN A CARRIAGE. LONGER AND WIDER THAN A KING-SIZE BED... SOFT AND GENTLE AS SLEEPING ON A CLOUD! Constructed of heavy-duty shipworthy nylon... easily supports 3 children—an average-size couple—or a football player of up to 350 pounds! When not in use, folds down to the size of a face towel... for easy storage in a drawer or car's glove compartment. Fully weatherproof... salt-spray resistant... built to withstand even heavy ocean conditions. Once up, no need to ever take down. Ideal for home, (indoors or out)... for camping, picnicking, beach—for deck of private boat—or to keep in trunk of car for use at any time, any occasion. FULL SATISFACTION GUARANTEED, or purchase price refunded at any time. But they are going fast; to make sure you do not miss out on this "direct-from-the-depot" sale, ACT NOW! LIMIT 5 per address.

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Marine Seamen's Power-Hoist... small enough to fit in glove compartment strong enough to lift 2,000 pounds—or tow a car out of a ditch—as easy as you reel in a fishline! Simply hook or strap one end of this MARINE SUPER POWER HOIST to any crate... outboard motor... freight... furniture... logs... fencing... construction material... even a car engine... ANY LOAD WHATSOEVER... and just simply wind away with just 2 fingers! Built in system of synchro ratio gears and pulleys does all the heavy lifting for you. Makes pounds feel like ounces! Comes with 65 feet of power lift cable; double grip safety hooks, heavy duty welded rings; lifetime rustproof rollers and rustproof cadmium housing. Wide variety of civilian uses: for car towing, lifting, moving, machine shop work, fencing, boating, camping, etc. LIMIT: 3 per address.

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Please \$0.50 on the following Marine Surplus Depot items indicated below. If I am not completely satisfied and delighted I may return within 14 days for a full refund (less postage and handling, of course).

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	107	Portable Air Pump	\$12	\$3	
	108	Cotton Towels	\$9 case	\$2	
CHARGE TO: (Minimum \$15)			VISA	MasterCard	TOTAL ORDERED
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Clean-Scrubbed Mountain-Fresh Air—All the Time!

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This Air Cleaner uses only 14 watts of power. It's whisper-quiet. It's compact and attractive.

But under its good-looking exterior thrums a mighty, powerful, industrial-strength heart. As it gathers the dust and pollution in the room, it disinfects and cleans the air, actually replacing dirty air with ozone-clean fresh air.

### Kills Air-Borne Germs and Mites

The CLEAN ACE Air Cleaner has a built-in ultraviolet light. This special lamp radiates on two separate wavelengths.

The first, lower wavelength converts the oxygen molecules in the air to ozone, destroying odors as though a hammer is smashing the offending molecules.

The second, high wavelength kills not only germs but also the tiny "mites" that can be so irritating (and socially unacceptable). You might notice an immediate **decrease** in the number of runny noses and colds. It's no accident.

### Will you Actually Feel Better?

We think you'll feel better because the air will be so pleasant and refreshing to breathe. Many, many people report the disappearance of their tiredness and general irritation when the air is properly ionized.

An opinion is one thing; a fact is another. The ability of the CLEAN ACE to kill germs and airborne pests is a **fact**. The feeling of well-being you get from fresh ozone is a **fact**. The oxidizing effect ozone has on bad-smell molecules is a **fact**.

Of course the CLEAN ACE is absolutely safe. The special ultraviolet quartz-glass tube doesn't transmit the high-range rays that can redden the skin. The unit plugs into any wall outlet, and because it "creates" fresh air you don't have to open a window.

### Unbelievable POWER

The home-size Model 8200 CLEAN ACE is 11" wide, 7½" high, 5" deep. It weighs only a couple of pounds. It makes no noise.



*The home-size CLEAN ACE Model 8200 cleans the air in an average room in about 10 minutes.*

Can you believe it will clean the air in an average room in about 10 minutes? Can you believe it works with every window shut and the heater or air conditioner on? Can you believe you'll be able to see the ugly black particles from your room the CLEAN ACE has trapped in its super-efficient filter?

You'd better believe it.

You don't assemble anything. We'll include a descriptive booklet, but there's nothing to learn: just press the "On" button and let it run.

### END EMBARRASSMENT FOREVER!

If someone is bedridden, somehow odors start to accumulate. Never again!

If even two or three people smoke at a party, the air is blue with smoke. Never again!

If you have a meeting in your office or conference room, after a while the air is heavy, even foul. Never again!

If you're cooking, the aroma of fish, shrimp, lamb, and many vegetables seems to hang there forever, gradually changing from "aroma" to "smell." Never again!

### Now—

#### A CLEAN ACE for Your Car!

The Model 1000 mounts under the dashboard or sits on the seat. Plug it into the cigarette lighter, and smog, pollution, grime, and stale air never will touch you.

What a difference clean air will make when you're driving around town or when you're stuck bumper-to-bumper in rush hour traffic, where normally you'd be inhaling the carbon monoxide from the exhaust of the car in front of you!

If someone is a smoker. Instead of driving around with smarting, burning eyes, turn on your CLEAN ACE Model 1000 and forget that cigarette or cigar is lit.

### COMFORT IS AS NEAR AS A PHONE CALL

We've seen old-fashioned air cleaners which lack the space-age technology of the CLEAN ACE, selling for up to \$245. New Horizons is a direct-factory source, and you'll be able to own this **high-powered** air cleaner for far less than you'd expect to pay in a store—if they had it.

#### Here's how to order:

The powerful home-size CLEAN ACE Model 8200 is yours for just **\$139.95**, plus \$4.50 for shipping.

The powerful automobile-size CLEAN ACE Model 1000 is yours for just **\$119.95**, plus \$4.50 for shipping.

Send check, money order, or credit card information (VISA or MasterCard) and we'll ship your CLEAN ACE Air Cleaner immediately.

### We Absolutely Guarantee!

After you have your CLEAN ACE, plug it in and use it for up to a full month. If for any reason you don't want to keep it, send it back for a full refund, no questions asked.

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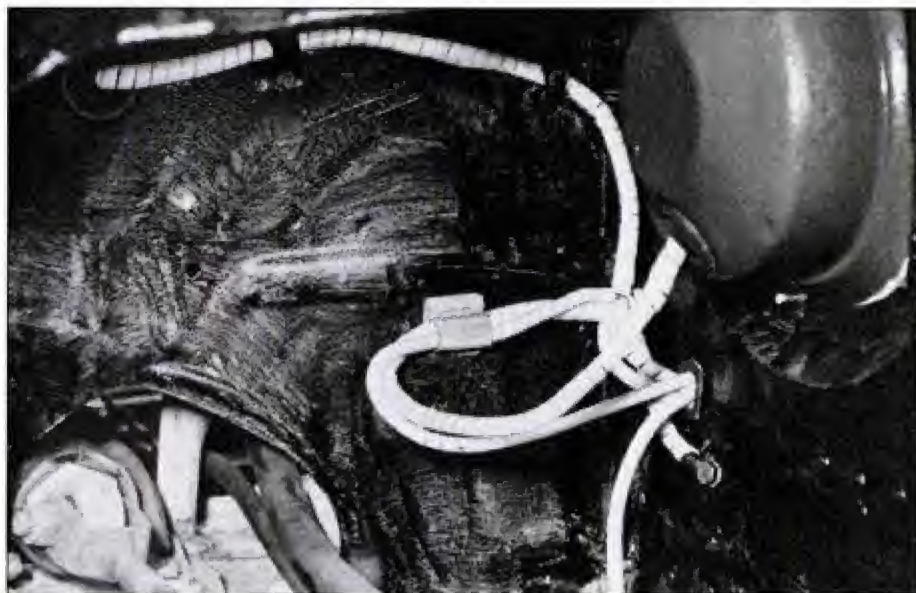
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New York, NY 10119



## Troubleshooting Headlight Wiring



**A**lthough this section deals with headlight wiring, use it as a guide to do the rest of your electrical system. The first step is to remove connectors from their plugs and solder the wires to the connectors. They usually only come crimped from the factory. The entire length of the wire up to the connector should then be heat shrunk. If there is a bundle of wires, use a plastic tie (check Vaco Products in Source list) to keep them together.

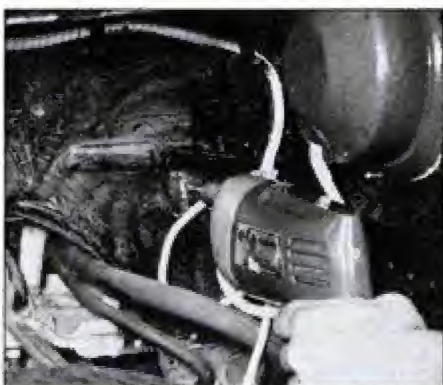
If the wires are exposed to the elements and subject to road abrasion, you can take the added precaution of using spiral-wrap plastic sheathing (Ain Plastics) or Convolux tubing (Raychem) to shield the harness.

If there is slack in the wiring, pull it out of the way of moving mechanical pieces and secure the slack with clips (Vaco). These clips are a one-piece, molded-plastic design with locking ribs which allow you to open the clip in case you need to move the wires out of the way to service the area.

When you mount the clip, use a nut and bolt instead of a sheet-metal screw. Screws inevitably work loose and fatigue the metal when you repeatedly retorqued them. Bolts with Nylock washers are the best bet.



*Soldered, wire-tied, heat-shrunk, spiral-wrapped and firmly clipped, these headlight wires are invulnerable to anything you and road can dish out. After this, they're maintenance-free for life. Connectors (left) should be removed and soldered, then installed in the plug and heat shrunk. Plastic wire tie is added to provide extra strain-relief.*



*To keep dangling wires clear of mechanicals, drill a hole and install a clip. It's best to use a nut and bolt, not a screw.*

PM

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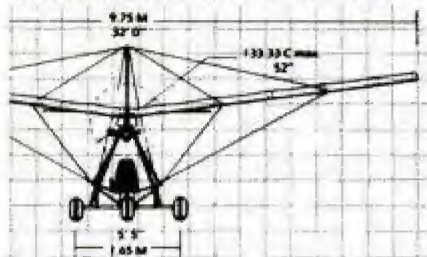


The Legend...



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THE ORIGINAL

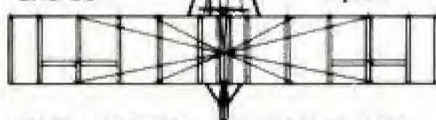
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# '83 CAR CARE GUIDE ELECTRICAL

## How To Install A Rubber Antenna

Commercial communications equipment, like the kind used by police departments, have used rubber antennas for years. But the product is now available for cars, thanks to a Swiss firm which introduced the new line this year. The advantages of this kind of antenna are obvious. They'll never rust and can't be bent or broken.

You can install a rubber antenna in your existing antenna mount. This is a straight swap installation. Due to their design, however, it's possible for you to install them on virtually any sheet-metal surface.

Spot the hole with a centerpunch and drill a 1/8-in. pilot hole. Drill the mounting hole with a 1/2-in. hole saw or body punch. File down the rough edges with a second cut file. Protect the raw hole with red primer and install the base of the antenna with the hardware provided in the kit. Attach the lead to the base and run it to your radio or CB. The antennas are already calibrated for either AM/FM reception or CB. Specify the particular kind you need before you make your purchase.

The antennas, from Fomo Products (Spycher & Beck Div., Box 4261, Akron, Ohio 44321), come in a variety of side mounts or flat-



Spot the hole with a centerpunch and drill a 1/8-in. pilot hole (above, left). Drill a 1/2-in. hole with a hole cutter (above, right). Deburr jagged edges with a file and coat edges with metal primer.



Install mounting base and fasten it with the nut and lock-washer provided in the installation kit (above, left). Attach antenna lead and rubber insulation boot and run it to radio or CB (above, right).



Once it is installed on your car, rubber antenna should last for years. It won't rust or break.

surface straight mounts and will cover just about any application. The rubber material in the antenna won't become brittle in cold weather. It's so flexible, in fact, that you can actually tie the antenna in a knot and still manage to get decent reception.

Mass distribution is just getting under way, so local auto stores may not have them yet.

Your best bet is to write to the main distributor and order direct, or ask where the antennas are available locally. Final pricing wasn't firm at press time, but they should cost about \$10 each.

FM





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## CAR CARE GUIDE

### How To Install Stainless-Steel Braided Hose

**S**tainless-steel braided hose has long been the standard for the aircraft industry and the hose of choice for any serious race team.

It has outstanding pressure and abrasion resistance and the synthetic material doesn't soften or become brittle at either end of the temperature spectrum.



*Before cutting the hose, wrap it with electrical tape or duct tape. This keeps the steel from fraying while you cut.*



*Clamp the hose loosely in a vise if you're cutting it with a hacksaw. Use a fine-toothed hacksaw to minimize fraying.*

Depending on connector fittings and diameter, the hose will withstand pressure up to 2,000 p.s.i. without fatiguing.

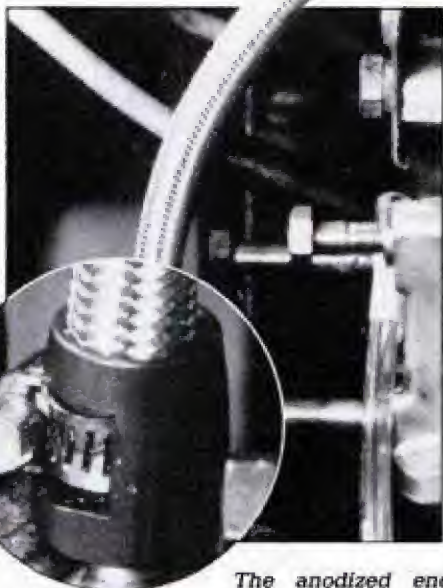
In a passenger car application, this hose is stressed so lightly that it will last virtually the life of the car. Once it has been installed, it can be ignored, except for checking clamp tension. The hose itself will never decay.

To replace a conventional hose with stainless braid, cut it to size with an abrasive cutoff wheel or a very fine-toothed hacksaw.

Before you cut, wrap a piece of duct



# STOP THE KNOCKS, SAVE AT THE PUMP.



The anodized end fitting contains a conventional worm screw hose clamp. This is perfectly adequate for virtually all street cars.

tape or electrical tape around the tube to keep the strands of stainless steel from fraying.

## No special fitting needed

Racers and aircraft applications use a special—and expensive—threaded fitting to attach the hose. You won't need to. A low-cost clamp with an anodized aluminum fitting is all you need. Slip this fitting and clamp over the head of the hose and install it.

We used Earl's stainless-steel braided hose and fittings, but several others market a similar product (see Sources). Local hot rod shops carry a variety of hoses and fittings.

For any given diameter, stainless hose is stiffer than synthetic rubber hose and, therefore, will not bend as easily.

When you replace the rubber hose, don't use it as a guide for the length of the stainless hose except in a straight run application. The stainless will have to be cut longer. Test the length before you cut.

PM



Install the aluminum end fitting and attach the hose. Tighten the clamp the way you would a normal hose clamp.



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 **CARTER.**

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# Replacing Vacuum Hoses

**W**ith the proliferation of vacuum hoses in today's cars, the chances for vacuum-related malfunctions or performance problems increase. Often, what may seem to be a major problem turns out to be nothing more than a few loose or cracked vacuum hoses. Heat, cold and fuel and lubricant contamination conspire to crack conventional vacuum hoses and you only know it when a problem occurs.

You can prevent vacuum leaks by replacing the existing vacuum hoses with Tygon tubing made by Norton and sold by Ain Plastics (see Sources).

Tygon tubing has been used extensively in chemical plants, sewage-treatment facilities and refineries. The main advantages are that the tubing remains pliable and crack-resistant in high and low temperature extremes, and will

shrug off oil and lubricant contamination and ozone deterioration. And, because it also has excellent pressure resistance, it can be used to replace the overflow tube and the



*High-quality Tygon tubing can be used to replace all the vacuum lines of your car as well as the radiator overflow tube and windshield washer tubes.*

windshield washer tubes. When you retrofit this tubing, remove one line of existing tubing at a time and install the Tygon. If you remove everything at once you'll never remember how to replace the maze of vacuum lines in most cars.

Ain Plastics will send you a catalog listing all the tubing sizes and performance characteristics. Tygon comes in a variety of inside and outside diameters and various wall thickness, so before you order, measure these three dimensions of your vacuum hoses.

When installing this tubing you'll want a snug fit on the connectors.

Also, make sure you make sharp, vertical cuts in the tubing. A bevel or "bologna cut" on the end of the tube might cause a leak and prevent proper seating of the tubing. The best tool for making the cuts is a new, single-edged razor blade.

FM

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## How To Install An Oil Cooler



Good oil cooler kits come complete with all you'll need for the job. Before ordering, specify the type of car, engine size and type of driving you'll be doing. For severe off-road, towing or high-performance use, you may need larger capacity unit.

Installing an oil cooler is one of the biggest favors you can do for your engine. It works just like a radiator, passing oil through metal tubes which are interwoven through a patch of cooling fins. An oil cooler reduces the temperature of the oil (which keeps it from breaking down) and extracts the maximum lubrication potential.

The cooler is very easy to install. Most oil cooler kits, like the Hayden unit we used, come with a complete installation package and a variety of adapters and fittings to adjust to most cars.

The first step is to remove the oil filter and install the sandwich adapter on the oil filter fitting on the engine block. Smear the gaskets of the adapter with oil before screwing it in place. The filter is then attached to the adapter.

The hose fittings should be put on the adapter before installing it on the block. Wrap the threads of the fittings with thread tape first to ensure a tight seal. Attach the oil lines with hose clamps and run them to the radiator.

The oil cooler is attached directly to the radiator by using knobbed nylon ties and locking collars. Thread the ties through the radiator, then thread them through the oil cooler and push the locking collars tightly against the oil cooler. Cut off the excess nylon ties. Attach the oil lines, check that all fittings are tight and start the engine. Make sure there are no oil leaks. If tightening doesn't stop the leaks, check your work for mistakes.

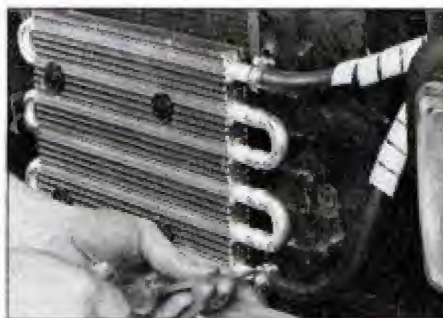
PM



Nylon ties are threaded through the radiator. In this case, we needed to use extra washers and spacers for clearance.



Wrap adapter fittings with thread tape before installing them on engine block. This will ensure a leak-tight seal.



Nylon ties are threaded through the oil cooler and locking collars are pulled tight. Cut any excess off the ties.

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# '83 CAR CARE GUIDE ENGINE

## How To Install A Gauge Panel

Holes for gauges in this panel were cut with sheet-metal body punches.



**F**or decades, automakers have been reluctant to install real gauges on dashboards. Instead, idiot lights have been used. In recent years, gauges have begun to show up more, however.

You can install a custom-made dash panel, as we did, or save some money by using premade panels from manufacturers such as Stewart-Warner. These panels are usually installed above or below the dashboard.

In either case, the installation of the gauges is similar. The working parts of a gauge unit are the sending unit and the gauge itself. The sending unit is installed in the existing fitting for the warning light sending unit. In most cases the old unit is removed and the sending unit for the new gauge is installed. This is a straight swap operation. The gauge is then hooked up to the sending unit by a wire. Two other wires, a hot lead and a ground wire, are then connected to the gauge. The hot lead should be a switched source that's activated with the ignition system.

Whenever you add any form of wiring to a car, always add a fuse to the circuit. If you're installing more than one gauge, use a common ground and common hot wire for all of them. A Moldex-type plug lets you remove the package as a unit.



In a multigauge panel, use a common hot lead and ground wire (above) to reduce bulk. When wiring is completed, insulate the bundle with heat-shrink tubing (left). Solder all connections. For access, use auto harness plug (below).





## Retrofitting Tires And Wheels



Wider replacement tires can aid your car's handling. Aftermarket tire (above, left) is contrasted with original-equipment tire (above, right). Antiroll-bar kits (right) come with good bushing, hardware.



**U**pgrading your car's suspension by retrofitting bigger tires and wheels and installing antiroll bars will definitely improve your car's performance and safety.

A wider wheel on the car will also marginally improve the treadlife due to the fact that the car's load is more evenly distributed across a wider footprint. The wider footprint will make your car hold the road better and, in most cases, stop quicker.

Well-tuned antiroll bars, also called stabilizer bars, that are designed in concert with a larger tire, can completely transform a car's handling. You might sacrifice something in ride quality, but the car will be easier to handle.

Just how much larger to go in tire size and stabilizer bar size is a matter of specifically tuning those items to your car. Suspension-tuning firms (see *How The Pros Rebuild A Car*, page 117) have done a lot of research and can suggest a specific make and size of tire and bar for some cars.

Before you make any kind of suspen-



Most antiroll-bar installations are simple. Bar is mounted to the body and the ends are bolted to control arms.

sion modification, make sure your existing suspension is in good shape. Check the shocks and the condition of ball joints and suspension bushings. If they're worn or in marginal condition, the added load imposed by bigger tires and antiroll bars will hasten their demise. At worst they might cause a failure. In any event, marginal components won't let you derive the maximum benefits of the new pieces.

Suspension-tuning information is now available from some manufacturers. Chrysler, Ford, Chevy, Buick and Pontiac all have performance divisions that will outline the steps necessary to fine-tune your suspension. **PM**

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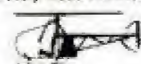


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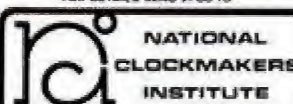
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## CAR CARE GUIDE

# Installing Silicone Brake Fluid

**S**ilicone brake fluid has been around for years, but until recently, has been found only in limited areas and in limited supply. Now, however, General Electric and other mass merchandisers have finally gotten around to selling this good stuff to the average car owner.

It used to be that you could find it only in U.S. Armed Forces and U.S. Postal Service vehicles. Those two groups converted completely to silicone brake fluid because of its superior water-resistant properties and high boiling point.

Conventional glycol-based brake fluid absorbs water quickly. That's why the labels always tell you to quickly cap a newly opened container of brake fluid and then store it only in a dry, warm area.

Glycol-based fluid can ab-



Silicone brake fluid is compatible with all existing brake systems and will extend the life of all your brake-system parts.



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**Rallye Grip** steering wheel covers are made of porotherm,™ a deep grained—leather-like surface. Rallye Grip provides great gripability—a luxurious feel—warm in winter—cool in summer . . . will not soil.

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## SUSPENSION AND BRAKES



To install silicone fluid, purge the brake system of existing glycol fluid and refill.

sorb up to 7-percent water by volume. What this means to you is the presence of water in your brake lines and cylinders, which eventually promotes rust and increases wear. Silicone brake fluid will absorb only  $\frac{2}{10}$  of 1-percent water. Glycol fluid will actually absorb water right through the rubber brake lines.

Silicone fluid also has a higher boiling point than glycol fluid, 500° F. vs. 400° F. This means there will be better brake performance and superior fade resistance in repeated hard braking applications.

Using silicone fluid is as easy as using conventional brake fluid. Bleed the brakes completely of all the existing glycol fluid and then refill the reservoir. Keep bleeding until the system is completely filled with silicone brake fluid.

While silicone and glycol will mix, the best results, of course, are achieved when you have a 100-percent solution of silicone.

Although silicone is more expensive than glycol—about \$14 per quart—chances are that it will last for the life of the car.

Water in your brake fluid will naturally freeze in winter. This causes damage to your brake system and radically reduces braking efficiency if too much water is in the system. At worst, this could cause a real safety hazard. At best, it will wear out the components of your brake system prematurely.

One final bonus of silicone brake fluid: It won't eat your car's paint if you spill some on the body. Glycol fluid will destroy whatever paint it touches. **PM**

# SAVE GAS!

## PATENTED-TESTED-PROVEN

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### EPA TESTED:

Fugett Products Company estimates UP TO SEVERAL miles per gallon INCREASE in mileage can be obtained with TURBO-CARB (depending on engine design and condition). Our company ACTUAL ROAD TESTS on a 1973 Chevy Wagon indicated an average of  $3\frac{1}{4}$  miles per gallon INCREASE, using a series of seven six-pound gallon cans of fuel, over the same stretch of Interstate (fuel used directly from can to prevent fuel tank error).

### WASTED FUEL—WASTED ENGINE LIFE!

Scientifically Proven — UNBURNED FUEL is major cause of ENGINE WEAR and AIR POLLUTION, CAUSES CARBON BUILD-UP and OIL DILUTION, resulting in further loss of mileage and performance! FACT — ALL NORMAL COMBUSTION ENGINES WASTE FUEL! With perfect combustion there is NO NEED for pollution equipment.

Gasoline WILL NOT BURN unless VAPORIZED! ATOMIZATION is the KEY to VAPORIZING. A droplet of fuel .008 thousands in size, broken up into four micron size particles, has 10,000 times the surface area for absorbing heat!

CARBURETOR MANUALS state: Raising the carb UP helps the HEAT to RISE for longer fuel heat exposure, also helps to equalize the fuel mixture before making the turns in the intake manifold, as the throttle plates tend to direct the fuel down the side, causing unequal distribution. Turbo-Carb Props are designed for TURBULENCE to prevent stratification of the fuel and for IMPROVED MIXING. Turbo-Carb compensates for air restriction (due to the screen material) with an enlarged hollow chamber and larger screen area, NO moving parts to WEAR OUT or BURN OUT, and designed to prevent possible engine stalling from icing. JUDGED SAFE by the EPA, when properly installed. An occasional shot of carb cleaner on secondary barrels, JUDGED Adequate Maintenance. Mounting instructions, bolts and gaskets included. Turbo-Carb can be used with WATER INJECTION and TURBO-CHARGERS.

### CUSTOMER COMMENTS (in letters on file)

- On a '77 Chevy Van I was getting 15 mpg. It increased to 20 mpg. Performance improved, it took the "ping" out and the installation was easy.—Gene Glaze, IN
- I am very pleased. It not only did what you said, but makes my motor on my Subaru wagon run MUCH smoother! A Real Gas Saver!—Roy Briskey, TN
- It's hard for me to believe the results I'm getting on my '77 Ford LTD. I went from 10 to 13.8 mpg, about 50% highway and 60% city driving with a lot of idling. Again thanks for a superb product.—Phillip Sirota, New York



## Turbo-Carb

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- For a '76 Ford Granada, it increased our mileage about 4 M.P.G. Enclosed check for a 1981 Ford Pick-up.—Henry Lilly, MO
- Turbo-Carb eliminated "ping" on my Harley-Davidson motorcycle, improved performance and mileage considerably.—James Lacy, IN
- I burn 25 to 30% less gas on my '76 Ford F-150-351. I am ordering one for a friend.—LeRoy Morris, MA

Hundreds of customers have indicated satisfaction—Order Today! **SATISFACTION GUARANTEED!**

Turbo-Carb Kits are available on a limited basis!

Not Available: (4 Bolt) Single Barrel or (3 Bolt) Carbs. Also—(2) Barrel GM 1979-83 6 cy 250, AMC & GMC 1980-83 4 cy 151 & V6-173, 20 and 22R Toyota. (Prompt refunds if we don't stock your model.) Must have 1" hood clearance, 1 3/8" on spread bore and quadrajet. (NOT FOR SALE IN CAL.) U.S. Currency Only.

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## CAR CARE GUIDE '83 INTERIOR

### How To Seal Weather- stripping

**L**eaks around weatherstripping occur because the weatherstrip itself has deteriorated or because the adhesive bonding it to the body has dried out, preventing proper sealing.

In either case, the fix is quick and easy—just buy the right replacement weatherstripping and adhesive.

Remove the old rubber and dried adhesive and make sure you've got a clean surface for the bonding agent.



Silicone-based adhesives also are available in large sizes for use with a caulk gun for major restorations.



Although you can use the car immediately after the repair job, the silicone will take a full 24 hours to cure completely.

The best bonding agents we've found are the silicone-based sealers available through a number of companies (see 3M, Ain Plastics in Sources).

These adhesives perform a dual function. First, they act as a glue to hold the weatherstrip to the surface. Secondly, when they cure, they form a water barrier on their own. Silicone adhesives dry to a semirigid, rubbery state that has a some compliance and resiliency. In the cured state, it isn't as prone to separation and cracking as conventional adhesives. In this application they're superior even to the cyanoacrylate "super glues."

PM

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## How To Install Sun Shades

**A** sun shade will keep the sun from baking your interior and bleaching the upholstery. One of the best we've found is a powered unit that automatically opens and closes when you turn the car on and off. It's wired into the ignition. The vertical runners can be cut to fit



The shade is installed inside the rear glass, not outside like most louvers.

for height, and the horizontal blinds are adjustable to fit virtually any width rear glass or hatch area. A 12-volt d.c. motor

rotates the blinds 90° from closed to full open. This sun shade was designed by the engineering department at Birmingham University in England and it is made with high-quality materials



Horizontal blinds are individually adjustable and fit even a tapered glass area.

throughout. A manual override fine-tunes the pitch of the blinds.

The vertical runners are installed inside the rear glass on rough-knurled posts. The posts are bonded to the glass with a cyanoacrylate-based glue. Once

installed, the shades are sturdy and don't rattle or shake over rough roads and bumps.

Installation takes less than an hour and requires only a fine-toothed hacksaw and some hand tools for the electrical connections. While expensive (\$149), the unit seems well worth the price because of its quality construction and design. The sun shade is available from Steingall Assoc. (see Sources).

PM



The vertical runners are cut to the correct length by using a fine-toothed hacksaw.

## HELP FOR THOSE ON DESERTED AISLES.



When a store sells everything from cat food to cosmetics, you can get lost trying to find a simple hardware item.

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But, at a SENTRY Hardware store you'll get all the help you need. From people who know hardware and sell it everyday. It's our business.

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Check the Yellow Pages under Hardware for the SENTRY store nearest you. SENTRY Hardware Corporation, Cleveland, Ohio 44113. Merchandise shown in this advertisement is available from participating dealers only. Offer expires May 31, 1983. All SENTRY dealers own their own stores. They select their merchandise and set their own prices. There may be variations in products, available quantities and prices in individual stores.



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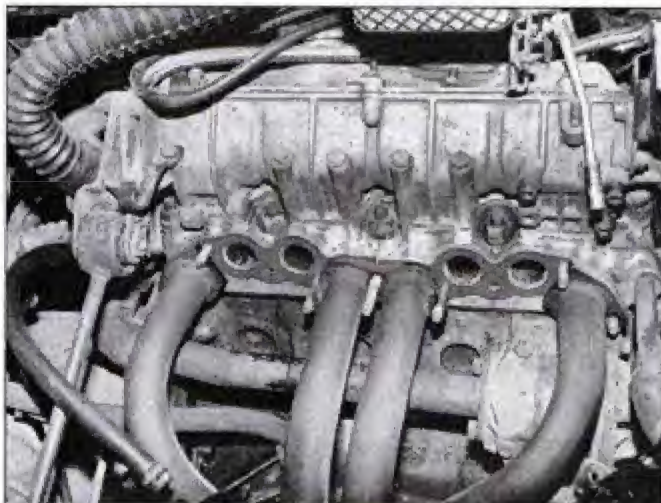
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## How To Install A Free-Flow Exhaust System



*This Faza unit installed in a Fiat has equal-length exhaust tubes and perfect alignment to the exhaust ports on the cylinder head (left). It needed no modifications and was installed in two hours. Any system you buy should provide same simple installation. Larger-than-stock collector, (below) was slotted and slightly enlarged to provide easy installation.*

**M**ost original equipment exhaust headers are simple "log" dump tubes. All the exhaust gases from the engine, or bank of cylinders, are dumped into a single log casting and discharged through a single collector. While this is economical for the manufacturer, it creates a certain amount of back-pressure for the engine and provides less than ideal exhaust gas scavenging.

A well-tuned, individual-runner header coupled with a low-back-pressure system will, in most cases, increase overall engine performance and increase mileage, as well.

In a Fiat test car we installed a Faza header and free-flow exhaust system and got a noticeable improvement in mid-range and top-end performance plus a .8-mpg improvement.

The time to install a system such as this is when your existing system needs replacement. There's no point in throwing out a usable exhaust system.

A well-designed system is custom-made for your make and model car and should be a straightforward remove and replace operation. The things to look for are exhaust runners of equal or



*The low-back-pressure, twin exhaust resonator (above) bolts up to the existing hanger without any modifications at all.*



near-equal length and a larger-than-stock collector pipe. Most good suppliers of exhaust systems such as Hooker, Cyclone and Faza perform dynamometer tuning of their units to make sure you get the most for your money.

Also, a good aftermarket unit should require no modifications or very few to the existing setup. **PM**

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## '83 CAR CARE GUIDE EXHAUST

# Replacing Sheet-Metal Screws

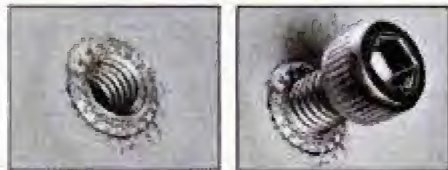
**S**heet-metal screws are a cheap and dirty, but unavoidable, manufacturing copout. In some areas they promote rust and metal fatigue and should be replaced with Tric-Nut threaded inserts, (see Technical Fasteners in Sources).

These threaded inserts are installed by removing the screw, drilling a hole of a proper size for the threaded insert and installing the insert by means of a special installation tool.



To install insert, remove sheet-metal screw (inset) and drill correct-size hole. Hole size varies with insert size.

The inserts are two-part collars that slip into each other during installation and press-fit tightly into the drilled hole. They come in a variety of sizes. Use them wherever sheet-metal screws are used to hold brackets, electrical components or ground wires. **FM**



Place the insert in the tool and install it in the sheet metal (top). The insert is permanently installed (above, left) and will accept any type of threaded fastener, like a hex-head screw (above, right).



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## Sources And Suppliers

Accel Performance Ignition System, Box 142, Branford, Conn. 06406; Canada: 500 Carlingview Dr., Rexdale, Ont. M9W 5H1 (sparkplug wires).

Ain Plastics Inc., 249 East Sandford Blvd., Mount Vernon, N. Y. 10550 (plastics).

Brown's Plating Service, Box 534, Paducah, Ky. 42001 (chrome plating).

Cannon Industries Inc., 9067 Washington Blvd., Culver City, Calif. 90230 (headers, suspensions).

Car N' Farm, Yel Co., Box 186, North Lake, Wis. 53029 (rustproofing).

CRC Chemicals, 885 Louis Dr., Warminster, Pa. 18974 (solvent, lubricants, chemicals).

DRI Industries, 11100 Hampshire Ave. S., Bloomington, Minn. 55438 (standard fasteners).

Dynatron/Bondo Corp. 2160 Hills Ave. N.W., Atlanta, Ga. 30318 (filler).

Earl's Performance Products, 825 East Sepulveda, Carson, Calif. 90745 (stainless-steel braid, oil coolers).

Faza, 2538 South Ridgewood Ave., Daytona, Fla. 32019 (seats, exhaust systems, wheels, carbs, induction systems).

General Electric, Silicone Products Div., Waterford, N. Y. 12188 (silicone brake fluid).

Geocel Ltd., Box 398, Elkhart, Ind. 46515 (foam urethane).

Hayden Inc., 1531 Pomona Rd., Corona, Calif. 91720 (oil coolers, auxiliary fans).

Kano Laboratories, 1028 Thompson Lane, Nashville, Tenn. 37211 (degreaser, solvents, penetrating oil).

Loctite Corp., 4450 Cranwood Court, Cleveland, Ohio 44128 (locking compound).

PDI, 1458 West County Rd., St. Paul, Minn. 48018 (adhesives, bonding agents, gasket material, solvents).

Plasti-Kote Co. Inc., Box 708, 1000 Lake Rd., Medina, Ohio 44258 (paint, primers).

Rocket Industries, 9935 Beverly Blvd., Pico Rivera, Calif. 90660 (headers, wheels).

Russell Performance Products Inc., Box 6253, Carson, Calif. 90749 (stainless-steel braided hoses).

Steingall Assoc., 227 48th St., Newport Beach, Calif. 92663 (window shades).

Stewart-Warner Industries Inc., 1826 Diversey Parkway, Chicago, Ill. 60614 (gauges).

Tabco, 5250 Naiman Parkway, Box 39474, Cleveland, Ohio 44139 (replacement body panels).

Taylor Made Products, 3200 West Market

St., Akron, Ohio 44313 (chemicals, solvents, grease, light lubricants).

Technical Fasteners Inc., 402 Highland Street, Syracuse, N. Y. 13203 (Tric-Nuts, fasteners).

3M, 23923 Research Dr., Box 2600, Farmington, Mich. 48018 (adhesives,

bonding agents, gaskets, solvents).

Vaco Products Co., 1510 Skokie Blvd., Northbrook, Ill. 60026 (wiring harness brackets, plastic ties, connectors, bulk lugs).

West River Ind., 3514 Palmer Dr., Cleveland, Ohio 44116 (dimple tool). **PM**

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## New Car Care Products

### Battery cable saver

You can repair the last 6 in. of corroded battery cable near the battery without having to replace the entire cable. Once you cut out the corroded area, you just splice in a Quick Cable Saver to the good section of the cable.

The Cable Saver kit comes complete with terminal, 6 in. of new cable and either a brass or lead coupler. A special two-piece insulating sleeve slides over the splice to protect against corrosion and short circuits.

Cable Savers cost about \$6 to \$9 for the most popular sizes and they are available at automobile parts outlets in your area. They are manufactured by



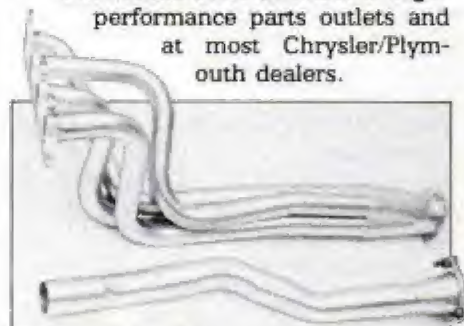
Battery cable ends allow you to splice a new length of cable to corroded section.

Belden Transportation Div., 2000 South Batavia Ave., Geneva, Ill. 60134.

### Performance pipe

If you want more punch out of your Dodge Charger/024 or Plymouth Turismo/TC-3 cars equipped with the Chrysler 2.2-liter engine, Chrysler's Direct Connection performance program has a new high-performance exhaust header. The header, part No.

P4286580, costs \$232.38 at high-performance parts outlets and at most Chrysler/Plymouth dealers.



Tuned performance headers for Dodge Charger are sold at Chrysler dealers.

# DRIVE A BARGAIN.

If you've been wanting to buy a driving computer or cruise control, now's the time.

Because right now Cal Custom is offering a \$5 rebate on each of these sophisticated products — the ZT-4 Driving Computer and the ZT-Cruise Control. They fit all domestic and foreign cars. And they're easy to install, so you can do it yourself. Both are great buys, too. Even before the \$5 rebate.

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on the ZT-Cruise Control. The ZT is more sophisticated than most original equipment cruise controls. After using the brake, a tap on the "resume" button will accelerate you smoothly back to your pre-determined speed. And you can adjust your chosen speed up or down by simply tapping another button. The coast/resume button makes the ZT ideal for congested highway driving. The small command module can be easily mounted on the steering column, console or under the dash.

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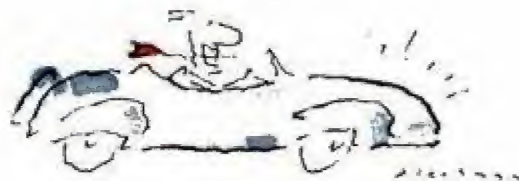
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### Hose cutter



*Hose-cutting pliers make quick work of slicing through rubber, plastic hoses.*

To get a clean, razor-like slice through all kinds of rubber and plastic hose, you need a specialized hose cutter. The Canadian-made Anderle Hose Cutter uses Swedish steel cutting blades. The tool also cuts body side molding and stranded copper and steel wire, but not solid wire or sheet metal. The cutter costs \$19.95 and replacement blades are \$4.50. They're available from Mac Tools, Box 370, Washington Court House, Ohio 43160.

### Power shears

A fast, convenient way to cut sheet metal, rigid plastic and other vinyl sheet materials is with the K-100 Portable Power Shears. It slices through metal as thick as 18-gauge at a rate of 180 in. per minute, and cuts plastic up to 3/32 in. thick. The shears weigh 5 pounds and cost approximately \$124. They're available from the Kett Tool Co., 5090 Madison Rd., Cincinnati, Ohio 45227.



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*Digital hand-held engine analyzer will perform a variety of tests quickly.*

For a really versatile and accurate hand-held engine analyzer, check out All-test's Model 3706 digital unit. The device tests tach, dwell, volts, ohms and amps on 2-, 4-, 6- and 8-cylinder and rotary engines; measures rpm on all ignition systems including GM's C-3 and C-4; and measures volts even on electronic modules in the newer cars. LED lights indicate a worn distributor cam or busing and defective alternator diode. The price is \$145 and it's available from All-test Inc., Dept. M-1, Box 65, Rolling Meadows, Ill. 60008. **FM**

### Diesel fuel filter



*Diesel fuel filter/water separator traps water in fuel before it reaches injector pump. The water drains from glass bowl.*

Water in diesel fuel is the No. 1 cause of blown injector tips and injector-pump wear. Racor's Model 200 FG filter/water separator removes virtually all water from diesel fuel through centrifugal separation. It also removes solid contamination. The filter alone sells for \$80, and with a mounting kit it costs \$130. It's made by Racor Industries Inc., Box 3200, Modesto, Calif. 95353.



## VIDEO CAMERAS

(Continued from page 82)

35 mm's rangefinder and can be found on the least expensive cameras. It gives a basic idea of the image area, but if you are planning to use a zoom lens, forget it. Optical finders are becoming less popular. You may find an older "bargain" camera featuring one, but, as our chart shows, they are not found on the newer models.

The next type, through-the-lens (or TTL), is based on the same principle as the 35-mm SLR—it allows you to see exactly what the lens sees. You can use

a zoom lens with this finder, and focusing becomes faster.

The last, and most sophisticated, finder is the electronic type. It can add about \$200 to the price of the camera, but it's worth the money. This finder is actually a miniature (1½-inch) black-and-white TV screen, and it shows you the exact picture that will appear, including contrast and brightness. Even more importantly, this finder allows you to play back recorded images directly from the VTR, so you can see immediately how your scene came out.

Some electronic finders can be

moved around, tilting in different directions when the need arises, and still others can be disconnected from the camera entirely for remote viewing.

Viewfinder information is also essential. The more data that is given the better. Most finders have LED indicators showing exposure information, battery usage, the VTR transport mode, color settings, and some even show the VTR tape counter, so you know exactly where you are on the tape.

### The lens

The lens is your next consideration. As with film cameras, some video cameras have removable lenses and some models have fixed-mount lenses, while other models use a C-mount, which enable you to use 35-mm camera lenses.

Almost all lenses have zoom capability, and the more expensive models add single-, two- or variable-speed power zoom for a more professional effect. The zoom ratio will vary from camera to camera. The most popular ratio, 6X (6:1), is usually from 12 mm to 72 mm (about 45 mm to 260 mm in a 35-mm format). Other ratios you might encounter will be 4:1 or 8:1.

Lenses come in varying sizes. A lens with a larger aperture will admit more light than one with a smaller aperture, but it will also increase the price of the camera. Generally, an F1.4 lens will let in 25 percent more light than an F1.6, but the F1.4 may not be necessary unless you are planning to shoot in dim light.

Most mid- to high-priced cameras provide macro-focusing (the ability to focus to within inches of a subject) and auto-focus.

### The iris

The amount of light falling on a video camera's imaging tube must be controlled for good picture quality. That's what the iris does, and there are two kinds: manual or automatic. Practically every camera has an automatic iris that sets the opening for a perfect exposure. Some feature automatic gain control (AGC), which averages these light readings. The least expensive cameras don't have a manual override, and the camera will make its own judgment no matter what the situation dictates. But there are times when this poses a problem.

Although the automatic iris can correct most lighting situations, there are some that it may not be able to handle. For instance, in backlighting, light coming from behind the subject can "fool" the auto iris into stopping down too far, thus darkening and obscuring detail from the picture. For this reason, you

(Please turn to page 186)



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# PM'S COMPLETE GUIDE TO VIDEO CAMERAS

Brand	Model	Price	Weight (lbs.)	Horizontal resolution (lines)	Sensitivity (lux)	Lens	Other features
Akai	VC-X1	\$995	5.3	270	50	F1.6 6× mpz*	Autofocus; two-speed zoom; autofade
	VC-X2	\$1,195	5.3	300	30	Same as above	Same as above
Canon	VC-10A	\$1,295	5.5	280	30	F1.6 6× mpz	Autofocus; variable zoom; autofade; character generator; interval timer
G.E.	3030	\$1,040	5.5	250	50	F1.6 6× mpz	Autofocus; adjustable finder; variable zoom
	3035	\$1,350	5.5	250	30	Same as above	Same as above, plus character generator
Hitachi	VK-C600	\$795	4.1	260	75	F1.6 6× mpz	Autofocus
	VK-C850	\$1,195	6.8	280	30	Same as above	Autofocus
	VK-C1000	\$1,595	3.8	280	100	Same as above	Autofocus
	VK-C2000	\$1,995	4.4	280	100	Same as above	Autofocus
JVC	GX-44U	\$770	2.6	270	70	F1.4 4× zoom	
	GX-78U	\$799	3.04	270	50	F1.3 6× mpz	Two-speed zoom; stereo audio
	GX-53U	\$895	2.7	270	30	F1.2 6× mpz	Stereo audio
	GX-59U	\$1,100	6.0	300	50	F1.6 6× mpz	Two-speed zoom; stereo audio; autofade
Magnavox	VR-8238	\$749	2.65	270	70	F1.4 4× zoom	
	VR-8269	\$1,399	6.0	250	30	F1.4 6× mpz	Autofocus; VCR transport control; variable-speed zoom; autofade
Panasonic	PK-756	\$1,050	5.5	250	50	F1.4 6× mpz	Fade control; autofocus; VCR transport control; character generator
	PK-802	\$1,095	5.1	270	40	Same as above	Variable-speed zoom; fade control; character generator; VCR transport control
	PK-805	\$1,200	7.0	240	50	Same as above	Two-speed zoom; autofocus; fade control; VCR transport control
	PK-956	\$1,295	5.5	250	30	Same as above	Same as PK-756
Pentax	PK-K030	\$1,095	3.5	250	60	F1.6 8× mpz	Fade control
	PK-K020	\$1,995	3.75	260	100	F1.4 6× mpz	Interchangeable lenses
Philco	VCC-099	\$749	2.65	270	70	F1.4 4× zoom	Rear-mounted mike
	VCC-112A	\$1,199	6.6	240	80	F1.4 6× mpz	Two-speed zoom; adjustable finder; autofade
Quasar	VK-743	\$1,350	5.75	240	30	F1.4 6× mpz	Autofocus; variable-speed zoom; adjustable finder; autofade
RCA	CC-012	\$895	3.3	NA	70	F1.4 6× mpz	
	CC-015	\$1,400	6.7	NA	30	Same as above	Autofocus; detachable finder; autofade; interval timer
Sanyo	VSC-450	\$599	4.4	250	100	F1.4 6× mpz	VCR transport control
Sears	53-812	\$939	4.18	250	75	F1.6 6× mz†	Rear microphone
	53-87	\$1,189	6.6	NA	50	F1.4 6× mpz	Fade control
	53-89	\$1,499	3.8	280	100	Same as above	Detachable handle
Sharp	QC-50	\$559	2.65	250	100	F1.6 2× zoom	Folding pistol grip
	QC-70	\$859	3.5	240	70	Macro zoom	Autofocus
	QC-40	\$1,099	6.17	240	100	F1.4 6× mpz	Autofocus
Sony	HVC-2400	\$1,200	6.3	300	35	F1.4 6× mpz	Detachable finder; autofade; record/review; positive/negative reverse
	HVC-2200	\$1,300	6.3	300	40	Same as above	Detachable viewfinder; autofade; record/review
Sylvania	VCC-114	\$749	2.65	270	100	1.4 4× zoom	
	VCC-116	\$1,299	5.7	NA	NA	F1.4 6× pz**	Autofocus; character generator; interval timer; autofade
Toshiba	IK-1900	\$999	4.4	260	50	F1.6 8× mpz	
	IK-1850	\$1,300	5.8	250	100	F1.4 6× mz†	Autofocus; interchangeable lenses
Zenith	VC-1200	\$750	3.7	NA	100	F1.8 3× mz	
	VC-1600	\$1,050	5.3	NA	40	F1.4 6× mpz	Detachable finder
	VC-1800	\$1,350	6.0	NA	30	Same as above	Autofocus; character generator; interval timer; two-speed zoom; autofade

\*mpz: macro power zoom; †mz: macro zoom; \*\*pz: power zoom. Note: All cameras have electronic viewfinders, except Sharp model Nos. QC-50 and

QC-70, and Toshiba model No. IK-1900, which have through-the-lens (TTL) viewfinders. NA: Not available.



## VIDEO CAMERAS

(Continued from page 184)

need a manual override (called a back-light switch). Many cameras have back-lighting compensation (BLC). It is usually automatic.

### Color

Proper light is not the only requirement for a good picture. Color balance and color temperature are equally important. Different light sources have different color temperatures. The color temperature of daylight has a bluish tint, incandescent (indoor) light has a

reddish tint and fluorescent light has a greenish hue. To compensate for this, the camera uses filters to change the color temperature.

Almost all cameras have a white balance control, which adjusts sensitivity to the three primary colors (red, blue and green) for perfect balance. The camera is aimed at a white card or surface, and indicators in the finder tell when it is set correctly. Mid- to high-priced models have an automatic white balance system, which is also used with a white surface, but instead of playing with color knobs you just touch a button and it is set automatically. The least

expensive cameras have preset white balance levels.

To adjust the color for a special effect, or to override the white balance setting, some cameras provide fine tuning color controls.

### The microphone

Video cameras also have excellent audio capability. Most cameras come equipped with a condenser microphone, and many manufacturers have placed the mike in a telescoping boom mount so it can be extended toward the subject. This is important because the mike won't pick up breathing or the camera's zoom motor, which is possible with a body-mounted microphone. In addition, some cameras have a rear-mounted mike, which is good for narration. Some newer models have stereo capability when using two or more mikes, and mixing is also possible on the more expensive cameras. The camera should have an earphone jack.

### Other features

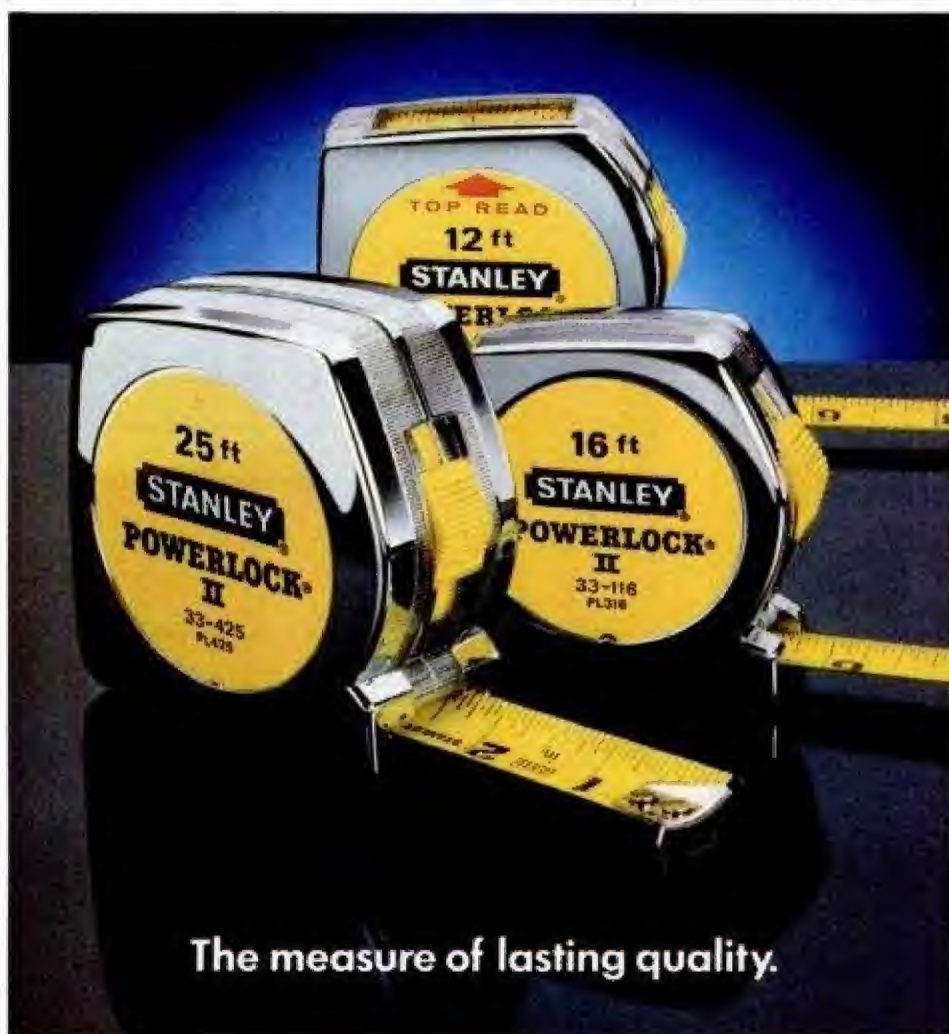
If you like a more professional look, many cameras provide a fade control, which allows you to move to and from a blank screen. It will either be automatic (motorized) or a ring that you rotate manually.

Another feature, auto-close, shuts the iris automatically when the camera is turned off or in the standby mode. This prevents costly tube burn-in, which occurs when the camera is pointed at a bright light.

If you want to make your own titles and credits for your home movie, one way is to write cards and place them in front of the lens. Another way is to buy a camera equipped with a character generator. This feature produces its own letters and numbers, and you can see them appear right in the electronic finder, superimposed over a scene you are shooting. Most cameras with this feature also include an interval timer. The timer is like a stopwatch, and elapsed seconds, minutes and hours can be superimposed over your scene of the Indianapolis 500.

If you are tired of constantly sending negatives out for enlarging, you may want to look at a new feature that some high-priced cameras provide. It's called positive/negative reverse, and it will (with an optional adapter) convert your negatives to positives for storage on videotape. Your slide collection can also be stored the same way.

If you like the idea of controlling your VTR transport functions (fast forward, rewind, slow motion and so on) right from the camera, you can, and the more expensive models will do it, provided you use a companion VTR from the same manufacturer. There are two major types of camera/VTR connectors



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on the market: 14-pin and 10-pin. Even if the camera and VTR have the same connector, the match might still be off because the pins might have different assignments. Each manufacturer has its own way of doing things. And if the proper match is not made, you will lose VTR pause control and viewfinder information such as battery status. One way to solve the problem is to purchase both camera and VTR from the same manufacturer. Another way is to buy Porta Cam Adapters from Cable Works (\$90), available at any video store, which will link virtually any VCR/camera combination.

## Specifications

Just like any TV, video cameras have specifications for differentiating the performance of various models. The first spec that you should look at is horizontal resolution. The average camera has 240 to 280 lines of resolution. The higher the figure the better. Next is the power-consumption rating. Most cameras require 4 to 10 watts, and the fewer the camera draws, the longer your VTR battery will last before it needs a recharge. Just about every camera has a standby switch that keeps the imaging tube warm while the camera draws only 1 to 3 watts.

The minimum light required is a specification that measures the camera's sensitivity. A camera that can go down to 30 lux is much more sensitive than a model which can only receive 100 lux. Some cameras automatically adjust for low-light situations. Others have a switch for low-light sensitivity.

The last, but not the least, specification to look at is weight. If the camera is light, you will be able to hold it comfortably for longer periods. Most cameras weigh between three and eight pounds, and it's a good idea to hold one for a while to judge whether it is right for you. The type of camera mount also contributes to user comfort. The pistol grip is vertical and extends from beneath the camera body, fine if the camera is light. Heavier models use a shoulder mount for added stability.

Finally, if you want to know the future trend in video camera technology, take a look at the new MOS (or CCD) cameras recently introduced. Replacing the conventional imaging tube (like Vidicons, Saticons and others) is an integrated silicon chip. The chip is composed of light-sensitive diodes and transistors, which reduce the size and weight of the camera. This new development also eliminates both tube burn-in and lag, and since they are tubeless, these cameras don't require a warm-up period; just turn them on and they're ready. But be forewarned: An MOS camera will set you back \$1,500 or more.

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## RESCUE BY A SATELLITE (Continued from page 81)

aviation frequencies, respectively). Under ideal circumstances, the EPIRB signal would be detected by an aircraft or ground station which would initiate a search and rescue sequence. In this case, however, it was not until 2123, (9:23 p.m.), about 12 hours later, that TWA Flight 904, bound from Kennedy International to Madrid, picked up *Gonzo's* signal. Perhaps the EPIRB did not function earlier, or the storm interfered with its transmission.

But unknown to anyone at this time, the signal was being picked up and stored by COSPAS, a Russian satellite.

### Estimates 300 miles apart

Flight 904's crew made a quick and rough estimate, by direction finder, of the signal source's position. They then radioed the FAA's Oceanic Control Center at Islip, Long Island. About 28 minutes later, a second aircraft, which also picked up the EPIRB signal, radioed a position, but it was some 300 miles away from the first.

Oceanic Control immediately called the Coast Guard Rescue Coordinating Center (RCC) at Governor's Island, N.Y., which contacted its Boston counterpart to learn whether it was monitoring an EPIRB or weaker ELT (aircraft Emergency Locator Transmitter). The reply was neither.

New York RCC had been briefed on the existence of a new satellite rescue system, so they called the main base for the system, Scott Air Force Base, in Mascoutah, Ill. Scott would know if the fledgling SARSAT network was operational. SARSAT, the acronym for Search and Rescue Satellite-Aided Tracking, is an international experiment (involving the United States, Canada, France and the Soviet Union) to

develop a worldwide system for locating ELT/EPIRB signals through doppler analysis by low-altitude, polar orbiting satellites. At the time of *Gonzo's* capsizing, only one satellite, the Soviet COSPAS, was in place. When Scott learned of the capsizing, it called on COSPAS to dump any pertinent data from its onboard computer and, within 12 minutes, COSPAS gave five possible positions—taken during different passes over the trimaran—for *Gonzo's* lonely cry.

### Water flows into hull

Meanwhile, Greene, Williams and Goodman waited. Because they had cut the first hole too low, water flowed freely in and out of the main hull. They stuffed the emergency lifecraft (which they never intended to use) into the hole and cut another hole on the opposite (leeward) side of the hull as a hatch. They organized one-hour watches during which each man remained outside to look for ships while the others rested below, trying to sleep on boxes placed on the stern deck to keep them above the water. They settled down to watches and munched candy bars and oranges. No one had much desire to eat, though they had food for 30 days. At no time did they see a ship.

At 2212 hours Sunday, the Coast Guard Air Station at Elizabeth City, N.C., was briefed by RCC New York and advised to launch a C-130 search aircraft; they were given a position for *Gonzo* that was an average of the five provided by COSPAS. Unfortunately, the C-130 was quickly forced to return to base due to mechanical problems and was relaunched at 0130 Monday.

Three hours later, the C-130 picked up the *Gonzo's* EPIRB signal. The air-



The *California Getty* passed by *Gonzo* after a failed attempt at rescuing the trimaran.





In high winds, the cutter *Vigorous* moved closer to bring aboard the *Gonzo's* crew.

craft's automatic direction finder, however, malfunctioned and was of no use in localizing the signal. However, within two hours of further patrolling, using the COSPAS average position, the crew saw flares rising from *Gonzo's* inverted hulk. The actual position, determined by inertial navigation and loran, was Lat. 40°, 28 min., 6 sec. N by Long. 64° 2 min., 24 sec. W.

#### 'All ships' message goes out

With *Gonzo's* position fixed, an immediate "all ships" message was broadcast from Portsmouth and Boston requesting positions of merchant vessels in the area. At 0710 the 870-foot tanker *California Getty* responded and voluntarily diverted her course to the *Gonzo*. A second vessel, the container ship *American Ace*, also began steaming to the scene in 35-knot winds and 25-foot seas. The C-130 next dropped two datum marker buoys. The buoys transmit homing signals on 275.1 and 240.6 MHz and do not interfere with EPIRB signals. And the C-130 was advised by its home base that the 210-foot medium endurance cutter *Vigorous* was 85 miles due west of *Gonzo*. At this point, updated positions from COSPAS were radioed to *Vigorous* from Scott.

By now the C-130 was running low on fuel and requested that the Canadian Air Force dispatch a P-3 from its base at Greenwood, Nova Scotia, to continue coordinating the rescue. At 0958 hours Monday, the P-3—picking up the COSPAS data on its onboard computers—made visual contact with *Gonzo* and assumed the responsibility for vectoring the *Getty* to the correct position.

#### Tanker hits trimaran

The *Getty* arrived at 1230. Although the wind and sea were still up, her master made four difficult attempts, over the next hour and a quarter, to maneuver alongside *Gonzo*. But she failed, in 20-foot seas, even striking *Gonzo* twice and throwing the crew into the water. The *Getty* then stood off to windward, giving *Gonzo* some relief from the seas, and awaited the smaller, more maneuverable *Vigorous*. At 1410

the *Vigorous* reached the scene. Five crewmen, in wet suits, helmets and harnesses, were stationed at the fore-castle; a backup team remained nearby, similarly suited. The *Getty* was asked to take a position 300 to 500 yards to windward of the *Gonzo* to break the seas for the *Vigorous*. (A later Coast Guard report was to commend the *Getty's* master whose "efforts were indeed valiant.")

Meanwhile, the cutter's master, Cmdr. Kenneth Thompson, approached *Gonzo*. By bringing the *Vigorous's* bow to windward of *Gonzo*, then letting her drift, under control, to the helpless trimaran, he enabled his crew to pass heaving lines and horse collars for *Gonzo's* crew to put on, enter the water, and be pulled to safety. It took only five passes to bring Williams, Goodman and Greene aboard one at a time. At 1523 the rescue was complete.

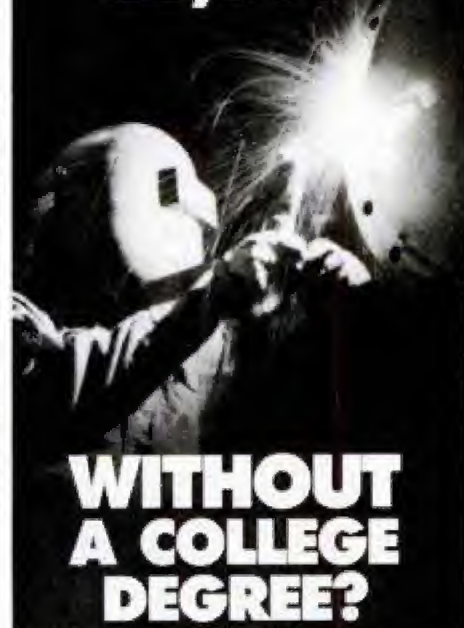
Greene, Williams and Goodman were found to be in excellent condition, a tribute to their experience and preparedness. After 30 hours adrift, they suffered no ill effects, not even bruised egos—sometimes the sea just has to win.

#### Hazard to other ships

The trimaran rescue has left the world with one problem. At this writing, several ships have reported *Gonzo* adrift as she follows the North Atlantic currents toward the Azores and beyond. She has averaged about 300 miles per month—a bit slower than her best racing speed. Another trimaran, *Rennie*, abandoned south of the Azores, is also adrift. They may present a hazard to passing vessels. One trimaran, capsized in the Caribbean last fall, was shelled and sunk by the Venezuelan Navy as she was a hazard to navigation. And Phil Weld's *Gulf Streamer*, which he abandoned in the Atlantic after she capsized in 1976, was picked up by the *Nikolai Ananiev*, a Soviet freighter on her way to Lisbon. There *Gulf Streamer* was transferred to another Soviet ship bound for Odessa, where the trimaran is now being sailed by an anonymous member of the Odessa Yacht Club.

Perhaps she was advance payment for our use of COSPAS. **PM**

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## TODAY'S TOP TUNERS

(Continued from page 97)

nals. And, there's even a voltage selector to use for other than U.S. voltages.

Though the Carver received stereo from farther away, the 3001 delivered by far the quietest FM performance we've ever heard from local and near-distant transmitters. We know that \$1,145 is a lot of money, but then the Tandberg 3001 is a lot of tuner.

### Carver TX-11

No other tuner has been so anxiously awaited as this impressive design from Carver. It incorporates a signal-tracking capability that is similar to that of the NAD tuner, but also introduces Bob Carver's revolutionary stereo detector for FM. This circuit doesn't affect either AM or mono FM reception. Instead, it eliminates some traditional steps in the FM stereo decoding process. It substi-

*Affordable (\$280) and selective, the Scott 558T tested as a high performer. Capture ratio and selectivity compare well with higher priced tuners.*



tutes its own interpretation of what that stereo signal ought to sound like. The circuit looks at the very clean mono FM signal for cues, and presents distinct outputs for your left and right channels. The stereo signal may vary slightly from what was actually broadcast, but the result is the stereo effect you want. The biggest benefit is the nearly complete elimination of hiss.

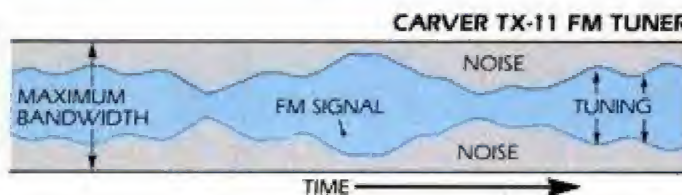
The circuitry is arranged so you can switch in three increasingly impressive degrees of quieting and clarification. Bob Carver felt that such an expanded FM range demanded yet another change or two: there is no mono switch and there are 16 FM memory preset buttons to store the locations of all those "new" stations. If a \$540 price tag doesn't scare you away, and if you like the idea of being able to receive

### STANDARD FM TUNER



*Standard tuning accepts noise as well as the FM signal. Such tuning takes in all of tuner's maximum bandwidth.*

*TX-11 adjusts its tuning bandwidth to the width of FM signal. This drastically reduces the amount of noise that's heard.*



distant stereo stations, the TX-11 may be what you've been waiting for. A car stereo version is in the works.

### Adcom GFT-1A

Because there are eight memory presets each for AM and FM stations, we anticipated that this tuner would pull in

ly and with excellent quieting. Like the Scott 558T, the 4150 is simple in appearance and straightforward to use. If your tuning is slightly off, a small arrow shows the direction in which you must adjust to be right on the proper frequency (FM only). A mute for FM quiets things as you tune the receiver and eliminates signals below a certain strength.

### Scott 558T

The Scott has more performance than you'd expect of a tuner priced at \$280. This tuner is an excellent bet for a discriminating music lover in a city with FM multipath and dial-crowding problems. It sorts through the FM jungle very handily, to isolate a signal. Adjacent FM stations of comparable strength remain reliably separate and don't intrude on each other with this tuner.

When switched on, the modest high-blend (processing of highs to reduce noise) did not deliver spectacular quieting on distant FM stereo signals. However, the high-blend did work subtly, not obviously, which was welcome when we didn't want to be distracted from the music.

### More reasons to buy

The decision to buy a separate tuner is a very personal one. If you are building a system from the ground up, a single unit combining amplifier and tuner—a receiver—is more cost effective and takes up just half as much of that hard-to-come-by shelf space for your stereo setup.

But a few of the new circuits within

more stations. It does, and quiet, firm tuning and effective elimination of any perceptible digital tuning noise make the GFT-1A a pleasure to use. Especially useful to those of us who raid the airwaves for music to put on tape was the *record calibration* button. If you turn it on, the tuner produces a steady tone that goes through your preamplifier and to a tape deck. You then set the deck's level for recording FM—any FM. As the owner's manual explains handily, there is a national FM broadcast level standard. Setting your deck once tells you where you'll get the best record levels for all FM stations.

### NAD 4150

NAD's newest tuner gets its good performance from a Schotz circuit that enables it to track FM signals accurate-

## SPECIFICATIONS—FIVE TOP TUNERS

Make	Model	Price	Bands	Presets (AM/FM)	AC-Off Memory Retention	75-Ohm "F" Connector	Stereo Hi-Blend Switch	Capture Ratio* (db)	Stacking Width (in.)
Scott	558T	\$280	AM/FM	7/7	1 day	No	Yes	1.2	17
NAD	4150	\$338	AM/FM	5/5	2 weeks	No	No	1.2	16½
Adcom	GFT-1A	\$375	AM/FM	8/8	None	Yes	Yes	1	19
Carver	TX-11	\$540	FM	**NA/16	None	No	Yes	1	17½
Tandberg	3001	\$1,145	FM	**NA/8	6 mo.-1 yr.	Similar	Yes	1	17¼

Note: All tuners feature digital tuning and scanning, except the Tandberg, which is analog.

\*Capture ratio is a tuner's ability to reject weaker of two stations on same frequency. The lower the capture ratio, the better.

\*\*Not applicable.



these tuners are still available only in separate tuner format (the Carver, Adcom and Scott units in our article, for example). The Tandberg and NAD are available as receivers. Keep in mind, if your current amplifier or receiver has performed well from an amplification point of view, adding one of the separate new tuners is a cost-effective way of conquering your current reception difficulties without having to pay the extra expense of replacing an entire receiver unit.

#### More sources for sound

Today there are more sources for sound, too, so a separate tuner permits you to use preamplifiers and integrated amps with greater input and output flexibility than most receivers on the market can offer.

A typical receiver handles one phono input, one or two tape decks and an auxiliary input. A good preamp also accepts another phono, perhaps another tape deck and up to three auxiliaries. If you plan to add a video disc play, a VCR and a digital compact disc (CD) player, you can see where the extra inputs on your audio equipment will get filled up.

Then, too, with separate tuner and amplifier combinations, you can combine features of both that aren't in

receivers currently on the market. (Some combinations offer switching for three pairs of speakers and dubbing between three tape machines—try and match that with any receiver model by itself.)

#### On the back panels

The list of standard tuner connections is brief: stereo outputs and antenna connector(s). More recently, the manufacturers have shown signs of recognizing that the antenna is a major component in radio reception. Connection with a 300-ohm pair of screws is standard, but manufacturers are now adding push-insert-release terminals. These are the same as found on the backs of many amplifiers where the speakers are connected.

The best connector of all is the 75-ohm "F" coaxial screw-plug. It offers complete isolation from interference, multipath and miscellaneous signal leakages. It is also the fastest to connect, disconnect and reconnect, which it does in about two or three revolutions of its permanently attached ring nut. This is the connector you see on cable TV, some computers and most video tape machines. The F connector is far faster and a good deal less short-prone than the 75-ohm binding-post-and-clamp connector usually substituted for

the real thing. Of the five tuners we examined, the Adcom has the F connector, while the Tandberg has a satisfactory European equivalent.

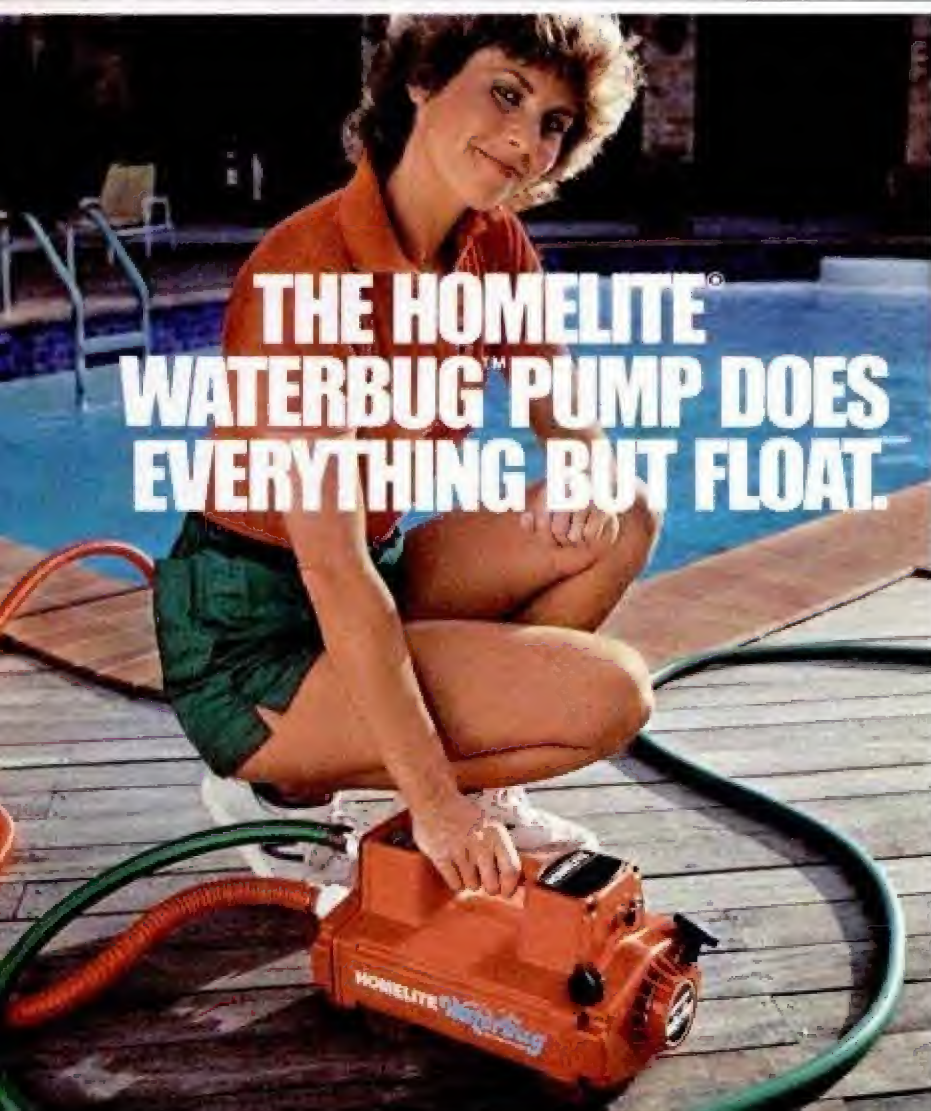
#### Other tuners

When we made our selection of five tuners for this article, it was not at all hard to find candidates. In fact, the choices were quite difficult—except for the absolutely unique Carver design, of course.

For example, three tuners in Sony's elegant ST-JS series matched three of the price levels we included—not to mention their obvious quality. The Tandberg wasn't the only costly tuner around, as we saw when we admired Revox's businesslike and versatile FM tuner/preamplifier, which goes for a mere \$2,399. Sansui's TU-S line has garnered praise from users who admire its excellent noise-quieting. Pioneer's revolutionary tuner design triples adjacent-channel selectivity and doubles stereo channel separation compared to what was thought possible before. It will be out in both tuner and receiver versions, but wasn't available when we did our listening.

Other manufacturers, too, are introducing separate tuners with specs that you should find are music to your ears.

FM



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## PACING THE PACK

(Continued from page 91)

to dive down into the lower part of the banking. It's strange, but here on this gray, overcast day in Indianapolis, the grass flanking the track is still bright green.

But here comes turn three. No time to think about grass. Dive left through the apex of the turn. Feel the suspension working, the tires clawing for traction. Crank in a little more left steering lock. We've got it now. Just hold it. Back off the throttle a little. The front tires are pushing.

### Down the chute

Now through the apex and nail it down the short chute between turns three and four.

Here's where Duke Nalon will punch the throttle to the floor, accelerate through turn four and make a sharp left onto pit road the day of the race. We make a mental note to back off to 85 on our next lap to see how the car feels accelerating up to 120.

But we're just about at 120 mph now and here comes turn four. Turn left. Steady throttle. Back off just a hair. Keep control. Don't oversteer. Through the apex. *Punch it!*

There goes the pit road entrance. Now straighten out. Steady. On the front straight. Relax for a minute and let the long straightaway rush toward us in a blurring of the senses. Feel the speed, the wind, the machinery at our command. Enjoy it.

The strip of bricks at the starting line, the only remnant of the old Brickyard track, rushes up under the car and is gone in a flash.

And now here comes turn one, and we can do it all over again.

### No ordinary Riviera

Clearly, this is no ordinary Riviera convertible. The Riviera XX is a highly specialized machine designed and built at Buick Engineering (their fourth pace car in recent years) under the direction of Ray Smith, overall Indy Pace Car Team coordinator; George Claypole, Pace Car Team project manager; and Ed Roelle, in charge of interior/exterior development.

You can't just walk into the Indy offices and tell them you want your new Bulgemobile to be the pace car for the race. Besides all the money you have to plunk down, there's the matter of how well your car performs.

There are definite performance criteria for an Indy 500 pace car. Don't forget that the pace car is out there in front of 33 snarling, charging race cars that are going about 150 mph when they take the green.

The pace car holds down the speed of

the pace lap to about 85 mph. As the cars enter turn four, the pace car must accelerate from 85 to about 120 mph and make a hasty exit onto the pit road, all the while making a hard left turn. By the time the race cars have left turn four and crossed the starting line, they're going about 150. And if you're in the pace car, you'd better be out of their way.

### Highly modified

There aren't many production cars today that can accelerate from 85 to 120 in a few hundred feet through a turn. That's why almost all pace cars have been highly modified in both engine and suspension to do things that ordinary street cars cannot do.

This year's Riviera is no exception. Besides Buick, 10 divisions of General Motors contributed engineering, fabrication, design and over 1,000 special pieces of hardware to the project. The result of all the man-hours is a vehicle that is at the leading edge in so many areas of automotive engineering that it's difficult to even begin describing the various systems on the car.

For instance, the engine may well be the most technically sophisticated powerplant to ever find its way into a car. Any car. George Claypole started with a Stage II 4.1-liter V6 block right out of the Buick Heavy Duty Parts catalog. Also right out of the catalog were a set of Stage II cylinder heads, crankshaft, connecting rods, head gaskets and various other hardware.

### Onboard computer

A digital onboard computer built by Delco Electronics controls all major engine functions and some minor ones, including the experimental electronic overlapping sequential port fuel injection system and the water/methanol injection system used to control detonation.

Twin 80-mm mass airflow sensors built by AC Spark Plug are linked to the computer to control the air/fuel mixture, and AC high-pressure, in-tank fuel pumps deliver the fuel. The computer also controls the distributorless coil ignition system, idle speed and turbocharger wastegates. The computer will even tell its designers what's wrong with the engine. It's programmed to self-diagnose 20 ailments. The radiator, built by Harrison, is a specially fabricated four-tube row unit with a high-density core. Helping cool the powerplant is a two-speed, 400-watt electric fan, computer controlled, of course.

### High-tech electrical system

The electrical system is about as high tech as you can get. The ignition system consists of a computer-controlled three-

coil unit sitting atop the engine. The computer figures out when each coil should fire in relation to the piston stroke, and fires it. That's all. No distributor. No complications. This will probably be a production item soon on many GM cars. The battery is an experimental Freedom III from Delco with an incredible 1,100 cold-cranking amps—enough power to start a diesel locomotive if need be. Keeping the battery charged is a high-output 108-amp. generator so small you'd think it was a 40-amp. unit.

### Twin turbocharger system

Capping it all off is a beautiful array of polished alloy tubing that makes up the twin turbocharger system.

"By using smaller T3 units," engine man Claypole says, "we cut the inertia way down and the turbine speeds up much more quickly, making power almost instantly. Thus, we have no turbo lag so common in single-turbo installations. And by using two turbos, we get the capacity we need to make as much horsepower as we want. Essentially, we've set it up as two three-cylinder turbocharged engines."

The computer calculates how much boost is needed in each gear to produce the programmed-in amount of horsepower desired. Hydraulic sensors in the transmission tell the computer what it needs to know. Then the computer varies the boost to the ideal setting in each gear.

It's been Ray Smith's unenviable job to get all this power generated by the engine to the ground.

Smith started with a basic T-Type Riviera suspension setup. That means higher spring, shock and stabilizer bar rates over a conventional Riviera suspension.

Modifications by Smith were few. He installed higher-rate front torsion bars. The rear stabilizer bar was increased in diameter from 22 mm to 26 mm, the front bar from 27 mm to 32 mm. The stabilizer bar link grommets were changed from rubber to harder polyurethane material to allow less flex. The steering gear was modified for more effort, and all the body mounts were changed to harder units.

### High-speed tires

Goodyear came up with special P225/70HR15 high-speed Eagle GT tires just for this pace car. They're mounted on custom-made 15x7 wire wheels manufactured by Appliance Industries.

Putting all this four-wheeled high technology through its paces was admittedly a thrill. It's been a long time since we've felt such devastating power in a car. Now if they'd only build one just like it for production. **FM**



## BROOKLYN BRIDGE

(Continued from page 87)

down through another tube—one with an airlock—and tools and supplies went down still another tube, also with an airlock.

Air pressure of up to 50 pounds had to be provided as the Brooklyn caisson sunk to depths of 44 feet and the Manhattan caisson went down just over 70 feet. (The Manhattan caisson never came to solid bedrock and was left standing in tightly packed sand. Studies show it hasn't moved a quarter of an inch in 100 years.)

Caisson workers removed matter from the riverbed and wheeled it out to buckets lowered into the equipment supply shaft or to excavations around the water shafts. Clamshell scoops lowered into the dredge tubes lifted out the crushed pieces of riverbed. The scoops were carried by pulleys hanging from hoists above the water level.

Since electric lights had not been invented at the time of the caisson construction, Roebling had to light the work area with candles and calcium lamps, known to the Broadway crowd as limelights. Better light was available from kerosene lamps, but in the oxygen-rich compressed air below, Roebling took no chances.

Not that he was able to avoid fire in the caissons. On Dec. 1, 1871, with the Brooklyn caisson sunk to near its final depth, a fire was discovered in a seam of the wooden ceiling in a work area. The blaze probably started slowly when a workman left a candle burning near an inside portion of the ceiling.

The hole made in the ceiling was just inches in diameter, but by the time anyone smelled smoke—a day after the fire started—firemen peering through the hole saw almost seven feet of smoldering wood. It was red hot.

Crews shot steam into the hole for half an hour, followed by streams of carbon dioxide. Nothing worked. Eventually, so much water was pumped into the hole that the water cascaded back out, and it seemed the fire was over. Unfortunately, the flames persisted and were discovered again several hours later near the roof. Over the next week, the caisson was flooded for two days, then pumped out. In all, it took two weeks to snuff the fire.

The fire damaged hundreds of square feet of wood, but it wasn't enough to affect the caisson. When it was pumped out, the structure was right and strong and showed no signs of buckling. Roebling had built it with four times more timber than necessary to perform the cutting-edge function,

and to serve as the bridge's foundation.

The two towers took almost six years to complete. The towers made the next innovative step in bridge construction possible: the making of the cables.

Roebling used steel instead of iron to make the cable, seeking to increase the cable's strength without appreciably increasing its weight. He also ran a continuous cable from shore to shore across the towers rather than linking them with iron eyebars.

To form the cables, Roebling designed the world's first on-site rope-spinning system. A rope going across the two towers and stretching from anchorage to anchorage conveyed a giant wheel pulled by stationary steam engines placed at the anchorages. Around the wheel the bridge crews looped a single strand of wire that would be run out about a mile from shore to shore, and up and over the towers. The wire played out of big drums 100 feet at a time. A pencil-thin strand of wire would be placed almost end-to-end with another strand. Then the two were connected inside a steel ferrule joint, which was clamped shut tightly against the wires.

Gripped in the teeth of the joint, the wire would play out and another was joined until about a mile of wire

(Please turn to page 195)

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High vacuum through the deck  
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It's amazing how many riding mowers are little more than lawn mowers with seats.

The Jacobsen® RMX™ Riding Mower, on the other hand, is a heavy-duty mowing machine, engineered for years and years of trouble-free service. With advanced design features that are inexcusably absent on other riders—easy-to-use features that help you get the big jobs done in a hurry, and in comfort.

Like the unique optional rear catcher that supports any standard round trash can, so clippings can be conveniently discharged directly into your trash can liner. And the innovative through-the-deck discharge system that even picks up pine needles and leaves.

Compare the RMX with other riding mowers on the market. In fact, test drive it! You'll see why it's earned its reputation as the most machine for the money.

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## POLISHING WITH A SANDER/GRINDER



Rockwell accessories (clockwise from top): brushing/cleaning belt, nonabrasive belt, rouge, contact wheel, platens.



The conventional way to polish: Charge a nonabrasive wool belt with some rouge.



The brushing/cleaning belt—a nylon web impregnated with abrasives—can remove rust or clean plastics and glass.



The nonabrasive wool belt is used to polish sheet acrylic edges. The platen should be removed unless the edges are square. Remove the table for greater access to the belt. You should apply light pressure during polishing.



Use the brushing/cleaning belt to restore beat-up golf irons. Keep the belt flexible by not threading it around the idler pulley. Use extra fine sanding belts to restore wooden golf clubs.

## OTHER SANDING AND GRINDING TRICKS



When you use Rockwell's contact wheel, position the machine to extreme right-hand side of bench for easy access.



Use the rubber contact wheel with a coarse belt for aggressive, fast stock removal, descaling and deburring.



The disc sanders available on the Dremel and Craftsman models are useful for sanding particularly small workpieces.



Obtaining precise angles is easily handled on the disc sander. The cast aluminum table with the miter gauge tilts to allow for bevel sanding and grinding.

## SANDER/GRINDER

(Continued from page 101)

4-in.-diameter rubber contact wheel (No. 31-362) used for fast stock removal, rough finishing and for flash grinding on soft metals.

In addition to the sanding belt, the Dremel and Craftsman models feature a 5- and 8-in.-dia. disc sander, respectively. Both disc sanders are available with a tilting table and a miter gauge.

### Applications and techniques

The sander/grinder can be used on a variety of materials, including wood, metal, aluminum, plastics, glass and rubber. The machine can easily sand and grind flat surfaces or contoured shapes of all sizes. Small-surface areas can be worked with precision by cutting a belt into a narrow 1/8-in.-wide strip.

**Caution:** Always wear safety glasses or a face shield when operating a sander/grinder regardless of the material or technique being used.

A major feature of this machine is its ability to sand internal cuts without the need of an access cut. To perform this operation, the belt is simply threaded through the opening in the workpiece, then remounted on the pulleys. **FM**



## BROOKLYN BRIDGE

(Continued from page 193)

stretched the full length. Every 100 strands of wire were gathered together to form a piece of rope. Then 19 pieces of rope were laid atop one another in a special geometric pattern devised by Roebling. With this pattern, they fit so snugly that the ropes formed a cable that would last practically forever. The cables were then tightly wrapped with wire rope to protect them from the salt air above the river.

So it was that the longest wire cables made for a bridge—and the only ones fashioned from steel—were spun out at the site. The four cables from which the bridge deck would be suspended each weighed 1.7 million pounds. Each was an incredibly tight 15¾ inches thick, 3,500 feet long and wrapped with more than 200 miles of steel wire.

With his stone towers in place and cables set up by October 1878, Roebling could now add the two final touches that would impress engineers for generations to come. First was his super-rigid system of hanging the bridge deck with criss-crossed suspenders and stays. The suspenders ran vertically, with the stays radiating diagonally from the towers. The webwork they formed would break up a sus-

tained wind, but more importantly, the bridge wouldn't give under the pressure of a high wind. Despite the fact that many civil engineers criticized Roebling for building the roadway so stiffly, it has survived several bridges that followed the conventional wisdom and allowed the roadway some give.

Once the roadway was in place in April 1883, the last major undertaking—the mass transit system—was ready to build. The cable train system took just a few months to complete and carried its first passengers in September, five months after the roadbed was finished and four months after the bridge opened on May 24, 1883.

In the first year of service, the cars carried almost 10 million passengers. The cable system was removed in 1908 to make way for tracks from New York's subway system. That continued until 1941, when the train service was stopped in a war economy.

Today, the Brooklyn Bridge accommodates 100,000 cars a day on business days and no fewer than 60,000 on slow traffic days. It's a toll-free bridge owned entirely by the city. (While the bridge was under construction, a series of controversies centering on disclosures about bridge board member William "Boss" Tweed led to the cities of Brooklyn and New York buying up all

outstanding stock. During the months of transition several bogus shares are believed to have changed hands, leading to the now-famous jokes about selling the Brooklyn Bridge.)

The bridge, by most accounts, is considered to be in such good shape that a New York City official told a recent gathering of civil engineers that New York might consider selling the bridge to a private company. George Schoepfer, chief engineer of the city's Triborough Bridge Authority, which handles only toll roads, said, "With tolls it could be a great business for someone."

In this centennial year it did become possible to purchase a small chunk of the Brooklyn Bridge. The bridge centennial commission sold little chunks of limestone from the anchorages for \$10 a piece. Each chunk was less than a handful, but the money was to go to a good cause: refurbishing some of the run-down areas around the bridge.

When the Brooklyn Bridge opened in 1883, President Chester A. Arthur and Grover Cleveland (then Governor of New York) crossed it and led the festivities. This year, President Reagan is invited to the repeat of the opener. The party will include descendants of the Roeblings, 19th-century vintage ships and more fanfare than New York City has seen in some time. **FM**

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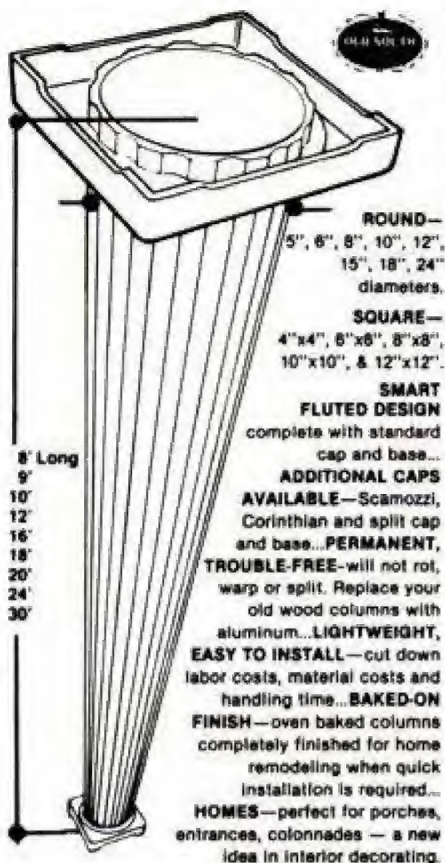
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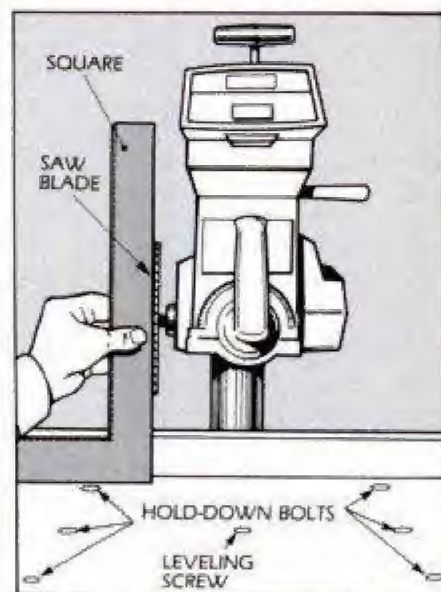
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## POWER TOOL MAINTENANCE

(Continued from page 109)



Adjust table level and true with hold-down bolts and leveling screw (if saw has one). Adjust the blade square to tabletop and reset the bevel index.



Square the arm to the fence with a framing square. Set miter scale to 0° when blade touches square edge at all points.



You should wipe the radial arm saw's tube column regularly with a clean cloth, then lubricate it with machine oil.

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Keep pawls clean; points must be sharp.

## BAND SAW



Clean the tires on band saw wheels with a stiff brush. If they're scored, dress surface with coarse sandpaper. If tires are overstretched, replace them.



Check blade tracking to be sure it rides at center of both wheels. If not, adjust tilt to get blade running correctly.

(Please turn to page 198)

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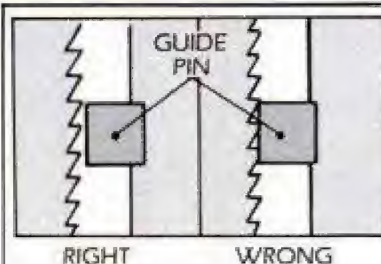
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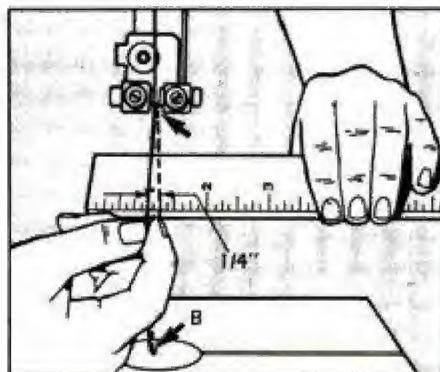
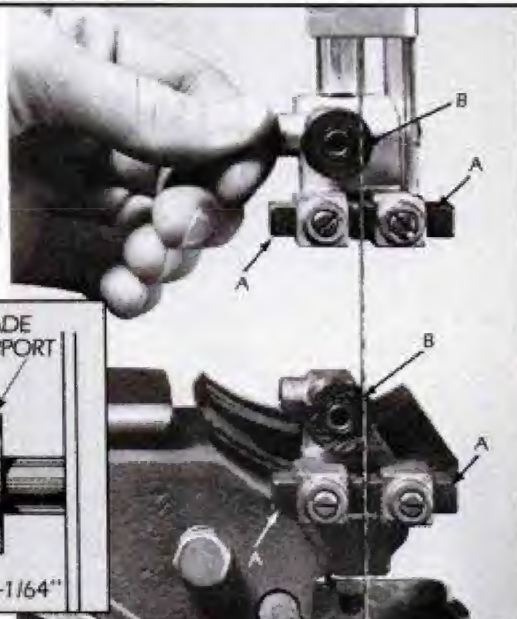
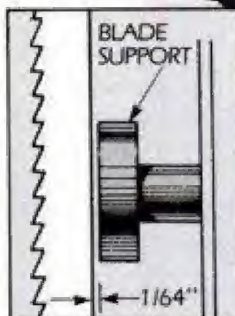
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## POWER TOOL MAINTENANCE

(Continued from page 197)



Align the upper and lower blade guides (A) and position them just behind the gullets. The guides should barely touch the blade sides when blade is at rest. Note correct clearance between blade supports (B) and back of blade.



The band saw blade tension can vary for some types of shop work. For most woodworking, tension blade so that light pressure will deflect it about 1/4 in. between A and B (about a 6-in. run).



Band-saw tables can flex at the blade-insertion slot at the front. Thus, many models are equipped with a leveling pin or screw. If yours has a pin-type adjustment, a few taps with a hammer should true the surface. Screw-type levelers must be turned to align the tabletop. After checking the table for trueness, check the relation of the table to the blade with a square. Reset the tilt indicator to 0 when they're at 90°.

## JIGSAW



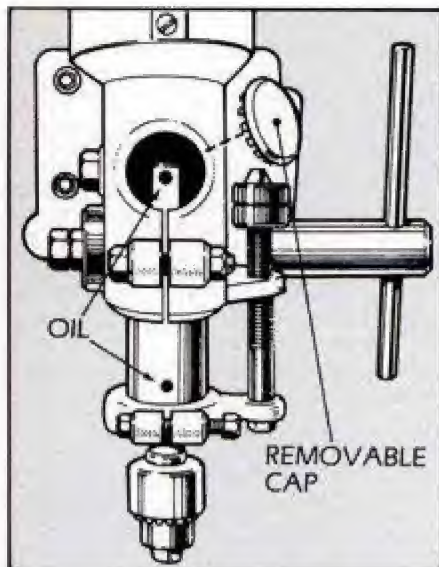
Keep blade guide and support correctly aligned to avoid frequent blade breakage.

## DRILL PRESS



Lubricating a drill press regularly in the right places will keep the machine running properly for a very long time. At least two times a year, it is recommended that you take off the pulley housing and apply grease to the inside of the spindle pulley. You should be sure to clean out any dust or grit that may have worked its way inside the pulley housing.





Remove cover plate on the head and put a drop or two of oil in the holes indicated.

## LATHE



Bring headstock and tailstock together; align centers. Adjust by using setscrews on either side of the tailstock.

## PLANERS



Align infeed and outfeed tables with a straightedge. If the depth-of-cut index does not read "0," adjust it.



With depth-of-cut set at 0, check the knife alignment with a spider gauge. Adjust knives to just touch screw.

(Please turn to page 200)

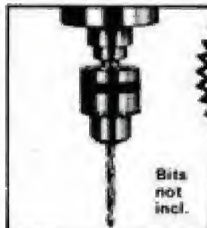
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## POWER TOOL MAINTENANCE

(Continued from page 199)

### STATIONARY BELT SANDER



When changing belts or after about 10 hours of use, check drive shafts where indicated and remove any belt threads that may be wound around them.

### GRINDER



When grinding surface of wheel becomes rounded from wear, true it with a dressing tool. Keep toolrest and shield clean and the slide well lubricated.

### COMPRESSOR



Replace air intake filter when clogged.

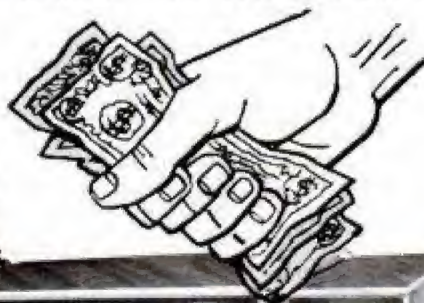
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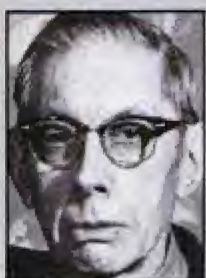


## PM Craftsmen Talk About Their Favorite Power Tools And How They Care For Them



Banister

I purchased a new Rockwell/Delta Uni-saw in 1960, and it has proven to be all I want in a table saw. The machine is consistently and absolutely accurate. Maintenance is minimal—the table saw requires just occasional cleaning and lubrication of the elevation and arbor tilt cranks with WD-40, never grease.—C.E. "Doc" Banister



Burton

First among all my shop tools is my floor-type Delta drill press with a rotary table. And there is some sentiment involved—it helped to build Corsairs and Normandy invasion ships during WW II. To keep it running right, I clean away grit and chips after every use and oil the chuck two or three times a year.—Walter Burton



Capotosto

The universal movements and the variety of available accessories make the radial-arm saw invaluable in my shop. I'm fussy about precision joinery, and clear visibility of the cut is the radial saw's big plus. Maintenance is a matter of keep-

ing one step ahead. After 20 years of constant use, my Sears Craftsman 10-in. performs as it did when it was new. I check and reset indexes regularly.—Rosario Capotosto



Warren

My prize lathe dates back to the period when Milwaukee Delta merged with Rockwell—a label on the headstock reads "Delta," another on the tailstock, "Rockwell." My father bought it secondhand in the '50s. He cleaned it up and used it for several years before leaving it to me. I cherish it not only for sentimental reasons, but because to buy comparable quality today would be expensive. I replaced the bearings about eight years ago and keep the lathe in pristine condition with thorough cleaning after each use.—Dave Warren



Wicks

Once you're used to working with specialized shop tools, it's hard to pick a favorite. If I had to give up all but one, I'd keep my 14-in. Rockwell/Delta band saw. I learned my maintenance habits from my carpenter grandfather who wisely advised, "Never start today's work in yesterday's dirt." Besides general cleanup, this means attending to tools regularly. Before starting a project, I check out adjustments on all my tools.—Harry Wicks

## Finding Owner's Manuals For Vintage Power Tools

In many cases, owner's manuals for power tools up to 35 years old and older are still available. When there's no original, manufacturers often provide photocopies of the original, or copies of the engineer's original plans. Often, you can even obtain drawings of discontinued parts so you can make them or have them made. When writing for information, specify serial number and model of the tool.

Atlas tools: Clausing Service Center, 81 Eisenhower Drive S., Goshen, Ind. 46526.  
Black & Decker (U.S.), Customer Service Dept., Box 564, Hampstead, Md. 21074 (information available for tools from 1918-present).  
Delta tools (see Rockwell International).  
DeWalt tools (see Black & Decker).  
Milwaukee Electric Tool Corp., Service Dept., 13135 West Lisbon Rd., Brookfield, Wis. 53005 (manuals available for tools 1963-present).  
Porter-Cable, Technical Service Dept., Box 2468, Jackson, Tenn. 38301.

Powermatic, Advertising Dept., Morrison Rd., McMinnville, Tenn. 37110 (information available for tools from 1920-present).  
Rockwell stationary tools: Technical Publications Dept., Rockwell International, 400 North Lexington Ave., Pittsburgh, Pa. 15206.  
Rockwell portable tools (see Porter-Cable).  
Sears' Craftsman tools: Sears, Roebuck and Co., Customer Relations, Dept. 731-A, Sears Tower, Chicago, Ill. 60684 (information not available for all tools from all years).  
Sioux Tools Inc., Catalog Dept., 2801 Floyd Blvd., Sioux City, Iowa 51102 (information available for tools from 1914-present).  
Skill Corp., Service Dept., 4801 West Peterson Ave., Chicago, Ill. 60646 (manuals available up to five years after tool was discontinued, other information available for tools up to 30 years old).  
South Bend Lathe, Customer Service, attn: Dean Hoffman, 500 West Sample St., South Bend, Ind. 46621 (manuals available from 1940-present).  
Thor Power Tool Co., Rte. 9, Box 104-AA, Johnson City, Tenn. 37601 (manuals available from 1950-present, not all tools from all years).  
Walker-Turner tools (see Rockwell International).

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## NEW PISTOLS

(Continued from page 93)

tridges which are not loaded commercially or for intermediate rifle loads like the .30-30 or .35 Remington. The .308 Winchester (7.62 NATO) full-length cartridge is considered a top load. More often, when the .308 case is used, it's shortened to about 1½ inches, making it very much a handloading item.

Why all this power in a handgun—even if it isn't really a true one-hand gun? Some are for hunting, but most are long-range, precision target guns used for metallic silhouette shooting.

In the Unlimited Class, these guns must knock down 50-pound rams at 200 meters to score. The competitor gets 1½ minutes per shot for five shots to make his hits—and must do it with iron sights. The challenge is so demanding and addictive (see *Silhouettes—Better Than Bull's-Eyes For Shooting*, page 84, Aug. '81) that the silhouette shooting game has spread across the country.

Many high-tech handguns are used for varmint shooting. Power isn't a consideration with these small targets, but accuracy is all-important.

### Hit harder than rifles

All of these special, long-range one-shooters have long, heavy barrels. Most have target or telescopic sights. They can all hit small targets at impossibly long ranges for handguns. And, most hit harder than some rifles.

Action designs range from top-break like the old, single-barreled shotgun to left-side, bolt-action, single-shots. Even the ancient rolling block—originally produced by Remington in 1865—has been adapted by Navy Arms Co. to become a high-tech handgun.

Besides convenience, a left-hand bolt can be more accurate for right-hand shooters. If they don't have to change the grip while reloading, the next shot can be placed more accurately.

Calibers have changed a lot since the introduction of the first long-range, single-shot pistols. The XP-100 was originally chambered for a special cartridge—the .221 Remington Jet. Now, with 200-meter, 50-pound rams to knock down on the silhouette ranges, it's not powerful enough and many old .221 XPs have been rebarreled to take more powerful cartridges.

Since even mild loads can leak, shooting glasses are a must when firing any kind of a gun. Ear protection is also important when shooting high-intensity cartridges in 8-, 10-, or even 14-inch handgun barrels. They are *loud*!

Many of America's finest factories and custom gun makers are catering to the high-tech handgun market. Thompson/Center Arms Co. (Farmington Rd.,

Rochester, N.H. 03867) was first with the T/C Contender. This break-action single-shot has the advantage of offering interchangeable barrels so the same frame can have a mild .22 rimfire barrel, a bucking .44 Magnum or .35 Remington rifle tube.

Barrels interchange by removing the fore end and driving out a pivot pin. The changeover takes only a few minutes and means that one gun can handle many different cartridges or kinds of shooting. Complete guns sell for \$265 to \$285.

Remington Arms Co. Inc. (939 Barnum Ave., Box 1939, Bridgeport, Conn. 06601) introduced the first of the single-shot, bolt-action handguns, the XP-100. It's now available for the potent 7-mm Bench Rest cartridge—a handloading proposition for silhouette shooters. This costs \$359.95.

M-S Safari Arms (Box 23370, Phoenix, Ariz. 85062) offers the Unlimited and Ultimate bolt-action, single-shot models. Both can be had with either fiberglass or walnut stocks. The Unlimited costs \$495 and the Ultimate \$595.

Wichita Arms Co. (333 Lulu, Wichita, Kan. 67211) has bolt-action, single-shot pistols. Prices for the MK-40 Silhouette Pistol start at \$595 and range up to \$3,250 for the Wichita Classic Silhouette Pistol.

Navy Arms Co. (689 Bergen Blvd., Ridgefield, N.J. 07657) produces a special model of their rolling block pistol for silhouette shooting and big-game hunting. Calibers include .45-70, .44 Magnum and .357 Magnum. List price with iron sights is \$375.

Sterling Arms Co. Inc. (221 Grand St., Lockport, N.Y. 14094) makes a new break action single-shot called the X-Caliber, which is \$249.95.

### Hand Cannons

One of the most innovative manufacturers is SSK Industries Inc. (Route 1, Della Dr., Bloomingdale, Ohio 43910), which specializes in barrels for T/C Contenders and custom work on bolt-action single-shots. Appropriately called Hand Cannons, custom Contender barrels ready to mount on your frame cost \$168.

Far less powerful, but equally expensive and perhaps even more sophisticated, are the competition pistols used for international match shooting. Most are automatics, many shooting the supermild .22 short cartridge because it is accurate and produces minimal recoil. For rapid fire or a moving target, these beat out all comers. They look even stranger than the high-power single shots and their looks are based on only a single criterion—performance. That's why these pistols are all so big, so heavy and so very expensive. They are the best we can build. **FM**



## VICTORIAN SIDEBORD

(Continued from page 104)

most of your sanding out of the way before assembling the cabinet. The flat areas can be sanded to the 120-grit stage before assembly and the final touchup, with 150-grit paper, can take place after the cabinet is built.

Dust off the piece and apply the stain of your choice. On the original, we mixed 4 parts Danish Walnut with 1 part Contempo Mahogany, both from Carver Tripp. The stain should be applied to one area at a time and you should make every effort to keep the stain on each section for an identical length of time. Wipe off excess stain with a lint-free cloth and set aside to dry overnight.

Next day, smooth any raised "whiskers" using 180-grit paper with a light touch. Dust off and wipe with a tack cloth before applying the sealer.

The sealer coat I use is 3-lb. cut water-white shellac thinned 50 percent with denatured alcohol. Apply the shellac using a quality bristle brush. Allow sealer to dry overnight.

The next day, sand lightly—where needed—using 180-grit paper. Dust off and wipe with a tack cloth. Pour off a small amount of the varnish (a half-full 1-lb. coffee can is just about right) and

thin it 50 percent with turpentine (turps). Apply the varnish, making certain you finish by tipping off.

Allow the piece to dry at least 24 hours. Next day, apply the finish coat of varnish as it comes from the can. Pour off the amount that you think you will need. (It is never wise to use the large

container as your work container. Neither should you pour back any varnish that has been exposed to the air.)

We selected a varnish that gives a waxed, or hand-rubbed, look to the piece: Varmor Satin R-11 from Pratt and Lambert. Let the piece cure for about one week before using it. **PM**

### MATERIALS LIST—VICTORIAN SIDEBORD

Key	No.	Size and description (use)		
<b>BASE CABINET</b>				
A	2	3 x 3 1/2 x 35 1/4" oak (front leg)	V	4 7/8 x 11 1/4 x 11 1/4" oak (front)
A1	2	1 1/4 x 1 1/4" dia. (rosette)	W	8 1/2 x 9 1/4 x 16 1/4" A/C plywood (sides)
B	2	3 x 3 x 35 1/4" oak (rear leg)	X	4 1/2 x 10 1/4 x 11 1/4" A/C plywood (back)
C	1	7/8 x 1 1/4 x 42" oak (bottom front rail)	Y	4 1/4 x 11 1/4 x 16 1/4" A/C plywood (bottom)
D	1	7/8 x 1 x 42" oak (lower front rail)	<b>SHALLOW DRAWER (2 REQ'D.)</b>	
E1	1	7/8 x 1 x 42" oak (upper front rail)	Z	2 7/8 x 3 1/2 x 19 1/4" oak (front)
E2	1	7/8 x 1 x 42" oak (upper back rail)	AA	4 1/2 x 3 1/2 x 16 1/4" A/C plywood (sides)
F	2	7/8 x 1 1/4 x 12" oak (front rail)	BB	2 1/2 x 2 1/2 x 18 1/4" A/C plywood (back)
G	2	7/8 x 2 x 23 1/4" oak (cabinet stile)	CC	2 1/4 x 16 1/4 x 18 1/4" A/C plywood (bottom)
H	1	7/8 x 2 x 3 1/4" oak (stile)	DD	4 Carved oak pull
I	2	7/8 x 1 1/4 x 11 1/2" oak (end rail)	EE	4 Pendant pulls
J	2	7/8 x 1 1/2 x 11 1/4" oak (end rail)	FF	2 False keyhole
K	2	7/8 x 1 x 11 1/2" oak (end rail)	GG	2 Double roller catch (Amerock No. 9714)
L1	1	3/4 x 8 1/4 x 23 1/4" oak (core panel)	HH	2 1 1/2 x 12" hinge
L2	2	7/8 x 2 1/2 x 23 1/4" oak (door stile)	II	1 3/4 x 18 x 48" Italian marble
M	4	3/4 x 12 1/4 x 14 1/4" oak plywood (end panels)	<b>Misc.: 1/4-in.-dia. dowels; 100-, 120-, 150- and 180-grit sandpaper, carpenter's glue, tack cloth.</b>	
N	1	1/2 x 16 1/4 x 42 3/4" A/C plywood (bottom)	<b>Finishing materials:</b> Stains: Danish Walnut and Contempo Mahogany, Carver Tripp, Box 2261, La Jolla, Calif., 92037. Varnish: Varmor Satin R-11, Pratt and Lambert Inc., Box 22, Buffalo, N.Y. 14204.	
O	2	1/2 x 16 1/4 x 24 1/4" A/C plywood (vertical dividers)	<b>Hardware:</b> 4 carved pulls (DD) B1204, 1 wooden knob (U) B1674, 4 pendant pulls (EE) E1426 from the Woodworkers' Store, 21801 Industrial Blvd., Rogers, Minn. 55374. Two circular escutcheons (FF) from Renovator's Supply, 745 Renovator's Park, Millers Falls, Mass. 01349 (product No. 20006).	
P	2	1/2 x 13 1/4 x 16 1/4" A/C plywood (shelf)		
Q	1	1/2 x 16 1/4 x 42 3/4" A/C plywood (top)		
R	1	1/4 x 28 1/4 x 42 3/4" A/C plywood (back)		
S	3	3/4 x 1 x 15 1/2" oak (cleats)		
T	20	1/2 x 1/2 x 15 1/2" maple (drawer slides)		
U	1	1 3/8" dia. x 2" (wood knob)		

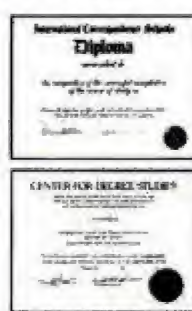
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(Continued from page 94)

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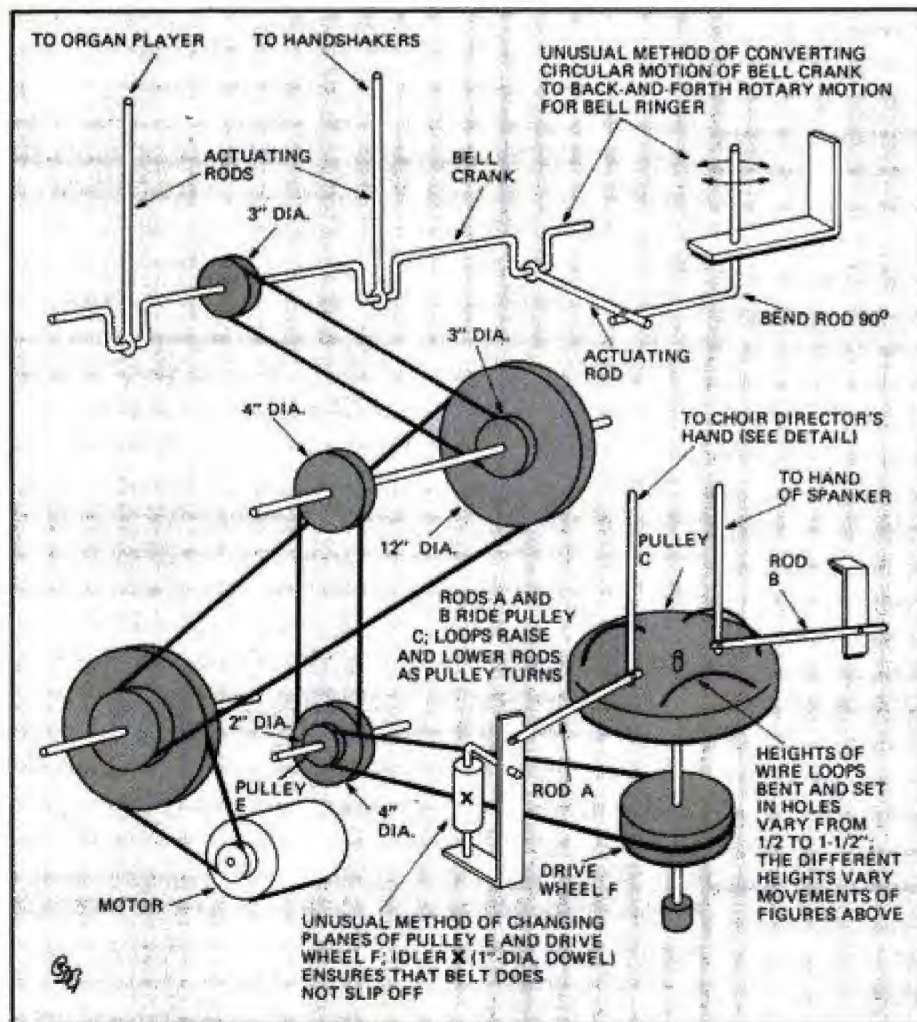








In "Mount Opel" a bell-ringer tolls a bell as friends shake hands in the background. In front, a child is spanked as a choir leader conducts. Below is the mechanical diagram.



## FOLK ART COMES TO LIFE

(Continued from page 105)

transmitting power to the job site, whether for milling grain or cutting lumber.

The seed of Carlton's mechanical ingenuity was planted in his childhood. However, experiences from his adult life have become the theme for several

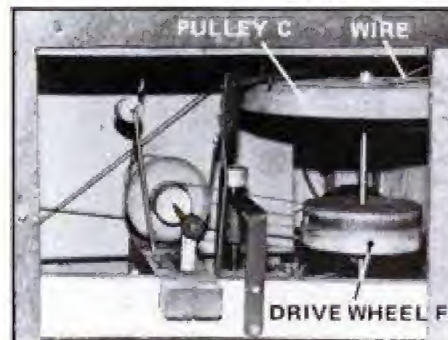
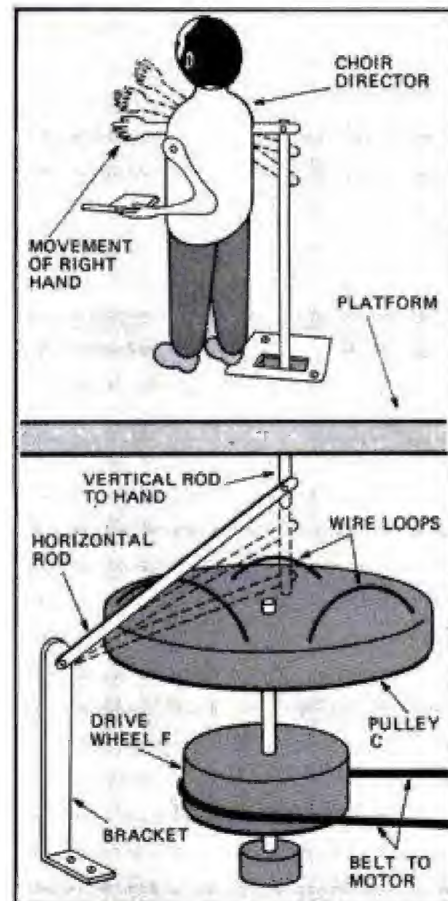
of his pieces. Most of his working life was spent as a craftsman in furniture factories.

It just seems natural to Garrett that the two major interests of his life—mechanics and wood—should come together after he retired over 11 years ago.

At about that time, Garrett entered the hospital for a stomach operation,



Detail of "Mount Opel" shows the choir director; see mechanical detail (below).



Partial view inside "Mount Opel" reveals the mechanics for the choir director.



and the doctor told him he would have to stay busy when he went home if he wanted to remain in good health. "As soon as I got home, I started whittling," Garrett says.

### Carving from memory

Before long he had immortalized his visit to the hospital by carving from memory a detailed scene of his hospital room.

This first piece, called "Hospital," is the only one of his large tabletop pieces that is not animated.

While Garrett was carving the figures for "Hospital," he began thinking of ways to instill life into his work. It wasn't long before his love of mechanics and a good supply of old electric motors found their way into the carvings.

The next project was a church scene called "Mt. Opel." With the flick of a switch, the whole congregation comes alive to the music of "Little Brown Church in the Wildwood." The arm of the choir director waves, a bell-ringer tugs a rope, the preacher thumps the

pulpit, and the organist plays away.

At one point, Garrett became an ordained preacher; he carved the preacher in this work to represent himself.

### Machinery is carver's theme

A progression was already at work in Garrett's thinking as machines became the focal point of his carvings—big machines, diesels, electric dynamos, drilling rigs, stamping arms and flying wheels. In a work called "Machinery,"

(Please turn to page 208)

## Make your own whirly toy

When pushed along the ground, the colorful wheels and knobs of this whirly toy spin. The mechanics of the toy are deceptively simple. However, achieving proper balance on the toy requires experimenting.

Although an artisan's work can never be duplicated, you can build a similar toy by following the plans below. They are modified to utilize common shop materials.

The base (A) is a 2x4 with its center portion removed to accommodate the mechanics of the toy. When the wheels turn, the rear pulley (B) turns to move the drive belt (I) and cause the top knobs (H) to turn. The lower drive belt, twisted in a figure-8, turns the front knob (J).

Cut the axle (C), shafts (G, K, O) and small wheel (N) out of dowel. Turn pulleys

(B, E, F, J), knobs (H, J) and wheels (N) on a lathe or carve them to shape. Cut the metal brackets (L, M, P, Q) with a hacksaw and bore attachment holes as needed. Secure brackets (M, P) in a metalworking vise at

the bend line; bend between two pieces of hardwood.

Paint concentric circles in bright colors on the knobs and paint the other wood parts in bright colors before assembly.

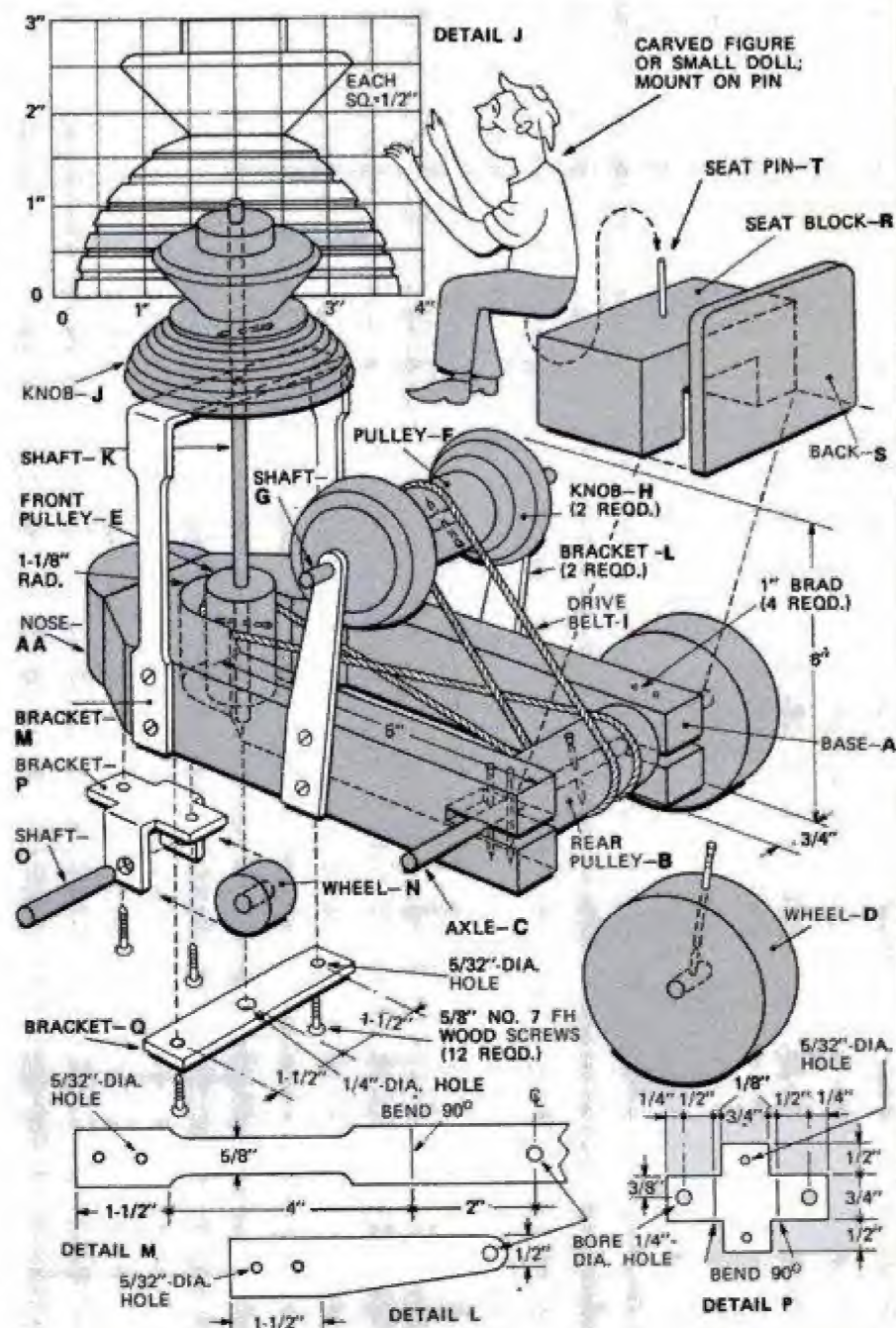


Wheels and knobs of the whirly toy turn as it is pushed along on the ground.

### MATERIALS LIST—WHIRLY TOY

Key	No.	Size and description (use)
A	1	1½ × 3½ × 8" pine (base)
AA	1	2"-dia. × 1" × 1½" pine (nose)
B	1	1¼"-dia. × 2" pine (rear pulley)
C	1	¼"-dia. × 5" dowel (axle)
D	2	¾ × 3¼"-dia. pine (wheels)
E	1	1"-dia. × 2" pine (front pulley)
F	1	1"-dia. × 2" pine (pulley)
G	1	¼"-dia. × 4" dowel (shaft)
H	2	¾ × 2½"-dia. pine (knobs)
I	2	20' drapery cords or twine (drive belts)
J	1	3 × 3½"-dia. (overall) pine (knob)
K	1	¼"-dia. × 10" dowel (shaft)
L	2	16-ga. × 1" × 4½" steel (bracket)
M	1	16-ga. × 1" × 15" steel (bracket)
N	1	¾ × ¾"-dia. dowel (wheel)
O	1	¼"-dia. × 1¼" dowel (shaft)
P	1	33-ga. × 2½" × 1½" (bracket)
Q	1	33-ga. × ¾" × 3½" (bracket)
R	1	1½ × 1¼ × 3½" (seat block)
S	1	¼ × 2½ × 3½" (seat back)
T	1	2d nail with head cut off (seat pin)

Misc.: ¾", 1", 1½" and 1¾" brads; ⅝" No. 7 fh wood screws; prime coat and nontoxic paint.





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**FOLK ART COMES TO LIFE**  
*(Continued from page 207)*

Garrett wanted to see how many items he could get to run at the same time. When you throw the switch, it looks as if the whirling wheels themselves are pulling together to produce the power. Therein lies the secret of much of Garrett's work: The recipient of power appears to be the producer. The real power of "Machinery" and of his other works is hidden under the table. It is usually a discarded fan motor.

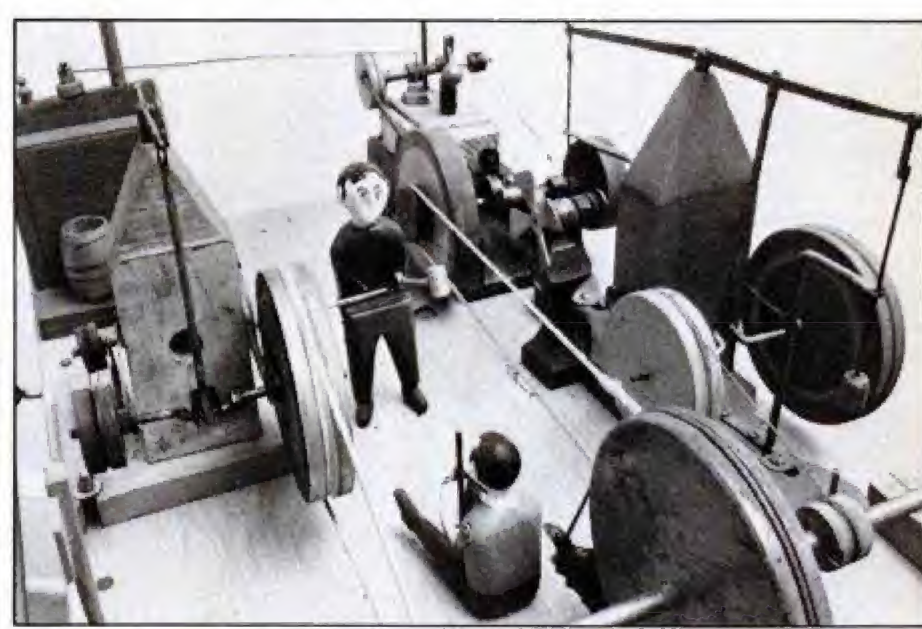
Besides his illusions as to the source of power, Garrett uses very simple devices to create movement in several different directions in a single work. In his "John Henry, the Steel Driving Man," power from the motor is transmitted all over the tabletop before it finally turns a flywheel on which a small, barely visible rod has been attached. It is this rod revolving on the wheel that rises and lifts the arm of

John Henry, then slips free, allowing the arm and hammer to fall. The piece illustrates the modern challenge of man against the machine.

Garrett's carvings richly portray everyday actions performed by his figures. In "Waterworks," for example, two workers are sitting together; one has a wrench in his hand, while his partner appears to be having lunch.

When Garrett is not busy planning a complicated multi-movement model, he spends his time carving figures and toys for the many children in his clan. The tractor at the beginning of this story, complete with sparkplug wire and a plow, is a striking example—one of a series of farm implements.

Miniature rocking horses are another Garrett specialty. His horses are about 6 in. high and have small riders atop them. Garrett's whimsical way with people carries over in his portrayal of the horses—many of them are painted with colorful polka dots.



The theme of manpower versus technology is seen in "John Henry." This man is one of Garrett's favorite folk heroes.



"Swing Around" is Garrett's most recent work. The brightly colored figures revolve while a cheery tune plays.

One of Garrett's smaller works is a pen of polka-dotted farm animals. More exotic-looking polka-dotted animals that resemble giraffes have also been in Garrett's domain. Animals with muzzles made of such items as pencil clips are also part of his menagerie.

Many of Garrett's works are now in the permanent collection of the High Museum of Art in Atlanta, Ga. For more information about the artist and his works, write to the Alexander Gallery, 3080 Pharr Court North, N.W., Atlanta, Ga. 30305. **PM**

Providing Garrett's works for photography: High Museum of Art, 1280 Peachtree St. N.E., Atlanta, Ga. 30309; Alexander Gallery, (address above). Mechanical consultant: John Gaynor. Research and story preparation: Michael Stowers



# TECHNOLOGY UPDATE

## AVIATION

### The 'wrong-way' jet

**A** set of "wrong-way" forward-swept wings were mounted on Grumman's X-29 jet earlier this year, leaving the equally odd canard stabilizer and the standard jet engine the only major parts not yet installed. The X-29 is to make its first test flight within a year.

The forward sweep isn't a new idea—the Germans used it in World War II—but the X-29 is expected to make it a standard of design by the 1990s.

Forward-swept wings give a plane far more lift than standard rear-sweep types. They also provide more fuel economy. But that extra lift puts too much stress on the wings. To overcome it, the Germans made very heavy wings, which tended to add so much weight that all lift advantage was lost. But Grumman's X-29 uses graphite composite materials which make the wings both light and strong.



Grumman's X-29 forward-swept-wing jet receives extra lift and fuel efficiency from the craft's odd configuration. A canard stabilizer is mounted forward of the wing.

### Foggy notion

**A** pilot's skill is never challenged more than in soupy weather, which is what makes Instrument Flight Research's Meteorological Condition Simulator (MCS) so intriguing. It's designed to let a pilot train in foggy conditions while flying on a safe, clear day. He goes up with an instructor, who holds the microprocessor-based simulator. The pilot wears glasses wired to the simulator. He can see the instruments clearly, but his peripheral vision is fogged by the glasses to simulate conditions ranging from zero to one-mile visibility. The fogging of the glasses is caused in much the same way as numbers form on a digital watch—pixel by pixel.



The Meteorological Condition Simulator can fog the pilot's glasses pixel by pixel.



### JUMP TRAINER

Marine Corps pilots who move from other types of aircraft to the Harrier II, which takes off vertically, are currently training on flight simulators. Now McDonnell Douglas has proposed a two-seat training version of the jet fighter. The Navy is expected to announce a decision later this year. The manufacturer says it could have the first trainer airborne by 1985.

## COMMUNICATIONS

### A case for communication

**Y**ou're stranded deep in the wilds of Brazil with the nearest telephone a lifetime away. Yet within minutes you're in touch with civilization, calling for help—thanks to your luggage. It's NASA's new remote communications system, which fits into two suitcases. One holds a collapsible antenna, the other a transceiver and display terminal. Link it to a 12-volt battery, aim the antenna at

NASA's ATS-3 satellite, and you will quickly be typing out a message that takes minutes to fly across the world. NASA, which has tested the device using its tracking stations to receive the messages, says pilots of all aircraft will find it useful. The Coast Guard and Drug Enforcement Agency are also expected to put such a communications system on line.



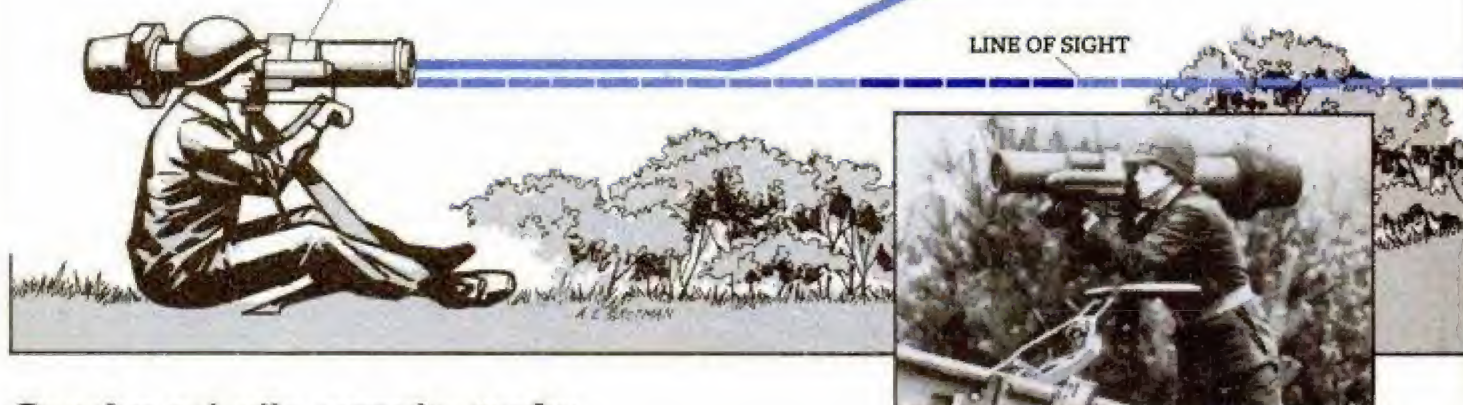
Remote communications system has collapsible antenna that fits in a suitcase.



## MILITARY

BILL MISSILE LAUNCHER

LINE OF SIGHT



### Sneaky missile outwits tanks

**T**his new antitank missile doesn't go where you aim it. As soon as it's fired from its bazooka-like launching tube, it zooms up about 3 feet above your line of sight and sails clear over an enemy tank.

An embarrassing miss? Not at all. When a proximity fuse in the missile's warhead senses the presence of a tank or other armored vehicle beneath it, an explosive charge is fired downward at a 30° angle, blasting the unsuspecting quarry from above.

Developed for the Swedish armed forces by Bofors Ordnance, the new missile is called BILL (for Bofors Infantry Light and Lethal). It's the

first in a series of so-called "top attack" weapons designed to take advantage of the long-known fact that huge battle tanks are much more vulnerable to fire from above than from the front. Frontal armor is very heavy—as much as 8 inches thick—in order to provide maximum protection from the usual head-on assault. On the other hand, the metal plating over the gun turret, engine compartment and other upper areas is relatively thin to save weight in places where enemy attack is not expected at all.

The downward-firing BILL thus strikes a tank at its weakest point,

## AUTOMOTIVE

### Detroit wires new cars

**A**merican auto manufacturers have long been in love with electronics. But this year's entries at the auto shows are wired with more spectacular electronics than ever. Ford has dazzled crowds with its loaded Continental Concept 100. And GM is showing off its Buick Questor Electronic Concept Vehicle.

The Continental Concept 100 has a satellite antenna atop its trunk to pick up data from transit navigation satellites. Turn on a dashboard cathode ray tube (CRT) and you pick up the car's location on a map that shows arteries to key locations.

There are no keyholes on the two cars. Just punch up a five-digit code computerized keypad on the rear of either car to



Ford's Continental Concept 100 is loaded with a wide array of electronic equipment.

unlock the vehicles. Another five-digit keypad on the dashboard replaces the ignition key.

The Ford demo car has a voice alert to warn you of unlocked doors, low fuel and other problems. Or you can give voice commands to start or stop the car or turn on electronics.

In both cars, the fuel-injection is electronic, and so is overall control of carburetor and engine functions.

There are all kinds of touches for comfort, including electronically adjustable seats and a rear seat built-in

Intellivision game. And sonar sensors—both in the front and rear—pick up sudden obstructions, such as a child running out onto the street, and rear dangers, such as another car's bumper that's too close for comfort during parallel parking.

To start the electronics in the Buick, you turn on a laser switch that turns on the computer. The GM car contains all the standard buttons, including windshield wiper, horn, turn signal and others, on a pad built onto the steering column. A center console features an audio disc player and other comfort controls. Both cars are fully operational. Neither is for sale—just for demonstration.

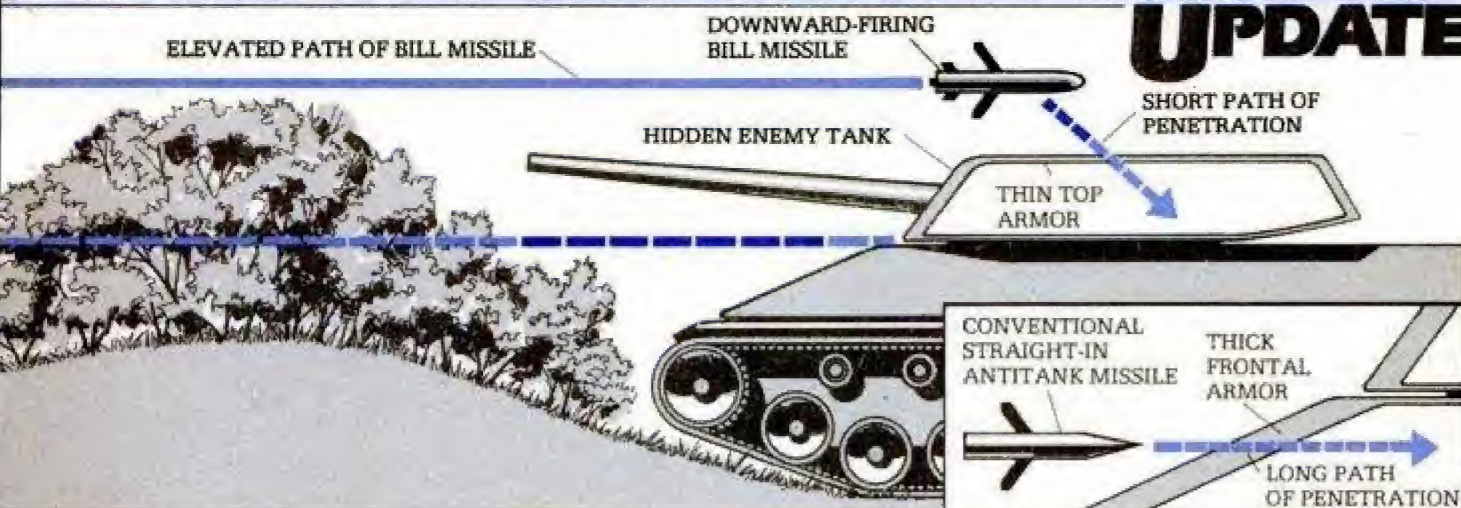
Editor: Dennis Eskow  
Contributors: Sheldon M. Gallager, Charles Reina, Ray Hamilton, Jack Grazier



Electronics in Buick Questor include computer screen (left), to pick up satellite maps, and column controls (right).



# TECHNOLOGY UPDATE



virtually assuring an instant kill. It offers other advantages. To score a decisive hit with a conventional line-of-sight missile, a gunner must normally aim at the narrow slit between a tank's turret and its hull—a tough shot.

By direct contrast, the BILL's elevated flight path eliminates the need for precise aiming, allows the gunner to shoot from a low, protected position, and makes it possible to hit targets partially hidden behind brush or a hill. The gunner need aim only in the general direction of a tank and the missile will seek it out. Even if it strikes the front, its downward-angled charge has a much shorter path of penetration since it's more nearly perpendicular to the slope of the armor plate.

The missile weighs under 60 pounds, including launcher, is readily portable, requires only a two-man team to operate it and has a range of more than 2,000 yards.

Will the U.S. Army adopt the BILL? Probably not in its present form, but something like it is bound to come. Our closest equivalent, the Dragon missile, is liked because of its low cost and will be kept in service for a while, although it lacks top-attack capability and is believed to be ineffective against the latest Soviet T-72 and T-80 tanks. Several replacements for the Dragon are currently under study, however. They are expected to be of the top-attack type and could be even more deadly than the BILL.

## SPACE

### Sailing to the planets

The 5.4-million-cu.-ft. balloon, its clear plastic envelope glittering in the morning sun, rises slowly, bearing beneath her the nearly 250-pound hemispheric open gondola. The orange and white basket contains hundreds of tiny sensors and microcomputers, all taking measurements of the air around the gondola. About four hours after launch, the balloon and its payload hover about 97,000 ft. above the



Scientists examine electronic parts after Galileo's drop test.

New Mexico desert. A command from a ground control radio activates a switch on high and the gondola is released from the balloon. Its sudden descent causes a parachute to pop out of its top and the fall is slowed to a graceful rate. So is marked another milestone in NASA's Galileo program to visit a moon of Jupiter later this decade (see *Technology Update*, "Testing By Javel" page 196, Apr. '83). The test flight, conducted last January, let scientists from Jet Propulsion Labs and General Electric test the accuracy of on-board sensors

that provide readouts of air temperature, moisture, chemical content and other data. The January test expedition also marked the maiden voyage of the gondola itself, which will be parachuted onto one of Jupiter's moons sometime before the 1990s. The gondola will be dropped again later this year for more tests of the electronic equipment.



## ENERGY

### New class of glass

Pittsburgh Plate Glass this month is introducing an energy-conserving, coated glass called "Sungate." The coating lets the sun's short-wave rays come into the home while keeping inside the longer waves of heat. PPG borrowed the idea from its aircraft glass division, which has used the plastic-coated glass concept for years. The coating, applied in several layers in a vacuum chamber, cannot be washed off. PPG says the coating gives a double-glazed window the insulation value of a triple-glaze. And the glass looks perfectly clear.



The clear coating on PPG's Sungate glass keeps the longer waves of heat inside.



## MILITARY

### Raider's a Whaler of a boat

**G**liding across the river, the 22-foot boat looks like a friendly old Boston Whaler, but those guns pointing from her gunwales fire something deadlier than harpoons. Ramo Inc. has taken the practically unsinkable Whaler hull and married it to M2HB, 12.7-mm machine guns—a marriage which *Jane's Defence Review* calls "an exciting example of synergism." The Raider is easily as maneuverable as any patrol craft in the free world, but it's much harder to knock out of the water. Made of lightweight fiberglass, the Raider can bomb along at 40 knots (and that's fully loaded with 6,500 pounds of men, machine guns, fuel, ammunition and radar). It's powered by twin Johnson 140-hp outboard engines.

Gunnery stations fore and aft are shielded with movable metal devices that run along a



The Raider combines the unsinkable hull of a Whaler with the firepower of 12.7-mm machine guns.

track so the gunner can aim in any direction. Between the two gun slots is a command station that houses a hydraulic steering system and various controls. The station can be outfitted with a radar tower and 600,000 candle-power spotlight for drug enforce-

ment or other patrols. The Raider, with a 120-gallon below-deck fuel tank, has a range of 250 nautical miles. And it even boasts fuel economy—the boat uses 16 gallons per hour at cruising speed and 23 gallons at top speed.

## ULTRALIGHTS



Police ultralight patrols at 800 feet in Monterey Park, Calif.

### Hang 'em high

**C**alifornia criminals may one day receive ultralight sentences. That is, the police closing in on them may be flying ultralights. Right now the low-flying craft with their 30- to 35-hp pull-start engines are doing traffic patrol and recon duty in Monterey Park, Calif. You don't need a license to fly an ultralight, but the police are following the spirit of the law and using a licensed pilot.

The Monterey Park craft cost under \$9,000 to buy and less than \$7 an hour to operate. However, the ultralight's limitations include slow speed—35 mph tops—and limited clearance; it can't fly much higher than 800 feet. Still, the craft can land in a 75-foot strip, and that advantage has permitted Monterey Park to create four landing-takeoff sites around town. Several southern California fire watch patrols are also using ultralights to try to spot the many fires that plague residential areas.

## INVENTION

### The big doughnut

**P**urdue University engineers are putting together what is expected to be the world's largest nuclear particle detector. Designed for Fermilab in Batavia, Ill., the doughnut-shaped particle detector is composed of 48 wedge-shaped modules, each containing a section of the doughnut's detection system. Inside each wedge are 33 alternating layers of steel and semi-conducting composite material. When two subatomic particles collide inside any of the modules, the result is a change in the surface of one of the composite layers, something similar to what occurs when light hits a photographic plate. That's how physicists will record particle collisions. When finished, the ring, which is being moved module by module, will be four times more powerful than the ring used at the European atomic agency, where earlier this year scientists announced discovery of the elusive "W" particle which is responsible for some types of atomic radiation. When the Indiana doughnut is in place, it will search for smaller particles.



Atomic collisions can be measured in Purdue ring's 48 wedge modules.



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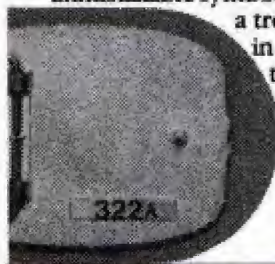
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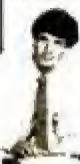
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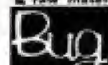
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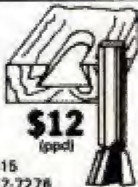


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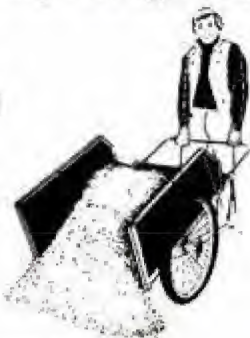


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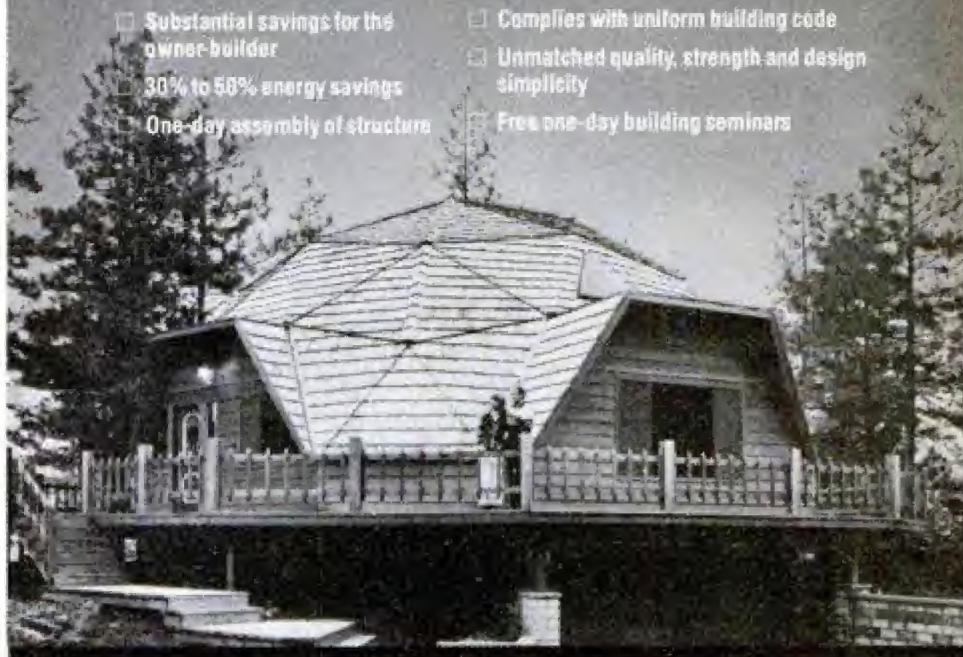
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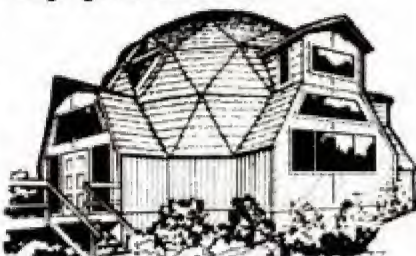
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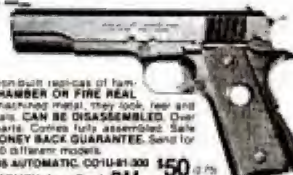
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### The Baja.

A strip of land below the California-Mexico border. It can go from an elevation of 6,000 feet all the way down to sea level at the drop of a sombrero. Its terrain is made up of jagged rocks, sand washes, a dry lake bed, tide pools, mud, silt beds, you name it. If you're a snake or a lizard, it's paradise. If you're an automobile or truck, it's hell.

Yet it was on this God-forsaken strip of land that this year's most newsworthy accomplishment in the world of trucking took place.

The scene—the annual Pernod/Score Baja 1000. The accomplishment—the third place finish in the mini pick-up class of the absolutely unheralded entry of the Isuzu 4 x 4 pick-up. The only diesel entry in the entire race, and the first imported truck to finish the race.

An achievement that becomes somewhat heroic when one considers these facts. The

Baja 1000 is a prestigious race that most truck manufacturers usually enter at substantial cost with crews, drivers and multiple truck entries. The Isuzu 4 x 4 was a single entry, with only its driver and owner, Henry Simpson, his co-driver, John Comacho and a very small crew.

Not only that, all the other entries benefitted from highly modified racing engines and transmissions. While the Isuzu benefitted from years of engineering know-how and required only a stock diesel engine and stock transmission.

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